SUPPLEMENT

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Section V.—Preventive Medicine and Tropical Hygiene.

(Continued.)

THE PSYCHOLOGY OF COLOUR.

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My experience of colour defect includes a personal interview with at least 4,000 red-green-blinds. To explain the inception of my present judgement it is necessary to go a little into detail. During the first seven years of my service in the New South Wales railways as Medical Officer, Holmgren's wools were a part of the official colour test. They were then replaced by Stilling's plates. Candidates were first taken into the colour testing room in batches of four and there examined one at a time by the wools. After this they were examined for visual acuity by Snellen's types and finally in a naked condition for physical fitness. Colour blindness only debarred a man from work on the running lines. After a short experience I detected a difference in the expression of face in a colour blind person and that of a colour efficient person during my examination by the wools. The colour blind person suggested to me a listening condition of expression and the colour efficient a watching condition of expression. The general impression of a colour blind face conveyed to me, therefore, as compared with the colour efficient face, was a want in its expression. I may here remark that quite a number of men, including intelligent and educated persons, who are colour blind, are quite unconscious of their defect until it is demonstrated to them. I also noticed that, when selecting the wools in the test, a colour normal person showed much more frequently a slight tremor of his hands and when spoken to, his voice was frequently not under the same degree of control as was a colour blind. Of course, a large proportion of the men examined were from an academic standpoint uneducated, the percentage of salaried and educated men being comparatively small. In ordinary conversation with a colour blind person his voice is wanting in emotional quality. When he smiles there is an absence of warmth in the smile and it appears to disappear more quickly than does the smile of a colour normal person. It does not linger for a few seconds in the face. I had difficulty at first, as a type used to crop up occasionally in which the voice and emotional condition closely approximated the colour blind in persons who were colour normal. I ultimately found that this condition was associated with tone deafness and at first, even after recognizing this defect, I had great difficulty in separating the one from the other in my mind. However, I now know that the colour blind man has inflection in his voice without warmth; that it does not show an equal response in emotion to the bright side of life and therefore its general tone is monotonous compared with the general tone of the colour efficient. The tone deaf voice has practically no degree of inflection of tone, although it has a quality of modulation. The physical tremor is frequently present in the tone deaf quite as frequently as in the colour efficient and there is more fire in the voice when roused than in the colour blind. To some observers, however, the one will be confused with the other, even when sufficiently educated by experience to recognize the colour blind type. I strongly suspect that Mendel law applies equally to the tone deaf as it is proved to apply to the colour blind and that a similar percentage may be found in each. There is an obvious psychological analogy between the two conditions. I have never found a man who is colour blind to be also tone deaf, nor have I met a man who is tone deaf to be also colour blind. I have never yet examined a women who is red-green-blind and my experience of women is very small as compared with my experience of men, but I have met one woman and one child who were quite tone deaf and it is a little singular that in each case there was a colour blind inheritance on the male side.

Quite a large number of men who are employed away from the lines on this railway, are colour blind. I meet these men in my rooms when they are recovering from sickness or when they have been injured and, as the medical history of each man is with me when I examine him each time, I see and examine him under conditions similar to the colour efficient man. I also know quite a large number of men outside the service who are colour blind, a number of medical men, school masters, artists and others.

Some time ago I published in *The Lancet* and other papers that stammering was much more common amongst colour efficient persons than it was in the colour blind and this is still my opinion. Since writing that, I have detected three cases of colour blind men afflicted with a marked stammer, but that nervous quaver in the voice which is so frequently in evidence in persons who are a little excited and nervous, is almost peculiar to the colour efficient.

A colour blind person in my experience has frequently an intelligent and alert mind. He is stable in his official duty and is not of the type from which emotional firebrands are made. A colour blind to whom colour is not interpreted to him in terms of sight, may have a response to what is analogous to colour in sight through sound.

SICKNESS AND ACCIDENT IN RELATION TO EMPLOYMENT.

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One of my duties as City Health Officer, Sydney, for the past ten years has been the examination of all new employees of the Sydney Municipal Council, the examination of employees on promotion in a department or transfer from one department to another and the examination of all absentees from sickness or accident and the certification as to their fitness to return to work.

As the number of employees is over 3,600 and includes 1,580 in one industrial concern, the Electricity Department, the field for observation of the amount and variety of sickness and accident has been considerable.

The importance of collecting accurate knowledge of absenteeism from sickness and injury is self evident either from the point of view of estimating the effect of the employment on the workers or from the utilitarian point of view of the considerable financial loss entailed thereby.

In the Sydney City Council service the regulations compel absentees from sickness and accident to furnish sick pay claims on a prescribed form in every case irrespective of the period of absence.

Claimants for sick and accident pay must to comply with the regulations in addition to furnishing a certificate by their medical attendant, be medically examined by the City Health Officer.

With regard to the analysis of the data recorded for employees in the Electricity Department it is noted that the claims for sickness are thrice the number of those from accident and that the hours lost from sickness are more than double those from accident.

It has been calculated in England that seven to nine working days per worker per year are lost through sickness and that this is four times that lost through accident.

The sickness rate among the 1,470 employees of the Sydney City Electricity Department in 1921 and the 1,580 in 1922 averages thirty-two and thirty-one hours respectively per worker, equal to four or five days of a day of eight or six hours.

The accident rate per man gives a loss of 14.3 hours in 1921 and 12.9 hours in 1922. The ratio of sickness to accident is therefore a little more than double.

It appears, therefore, that the loss through sickness is considerably below the English average and that the loss from accident compared to that from sickness is half the English rate.

After consultation with Dr. A. J. Lanza of the International Health Board of the Rockefeller Foundation, Industrial Hygiene Expert Adviser to the Commonwealth Health Department, and Mr. H. A. Smith, the New South Wales Statistician, we are arranging the collection of sickness and accident rates by age groups and using the international classification of the diagnosis of illness.

The records of sickness and accident we have compiled for the past five years are especially interesting in view of the relationship to hours of work.

At the beginning of 1920 the Sydney Municipal Council introduced a forty-four hours week with no Saturday work. At the end of 1922 there was a reversion to the forty-eight hours week. For twenty-six months Saturday work was eliminated. This did not apply to the members of the indoor staff who worked on one Saturday in every three, nor to the City Health Officer who being also Metropolitan Medical Officer of Health is subjected to the regulations of the Public Service Board.

The figures show a material reduction both in sickness and accident rates during the period of no Saturday work. The records for the year previous to the operation of the forty-four hours and for the year subsequent to the reversion to the forty-eight hours week are as follows:

Table I.

Period	Sickness		Accidents		Total	
	Number	Rate per 1000 Employees	Number	Rate per 1000 Employees	Number	Rate per 1000 Employees
Nov. 1919—Oct. 1920	1532	486.9	448	141.6	1980	628.5
Nov. 1920—Oct. 1921	1529	440.3	438	131.5	1967	571.8
Nov. 1921—Oct. 1922	971	273.1	439	123.7	1410	397.6
Nov. 1922—Oct. 1923	1575	441.1	475	133.3	2050	574.4

In the first and second periods there is little difference, but in the second year the sickness rate per thousand employees shows a decrease of 46.6 or 9.4%, and that of accident 10.1 or 7.1%, the total decrease being 56.7 or 8.9% for the period without Saturday work.

With regard to the second period which was the first year of the operation of the reduced hours, during the months of July and August there was an epidemic of influenza affecting one hundred and ninety-seven and one hundred and fifty-two employees, whilst in the corresponding months for 1920 the numbers were one hundred and nine for July and thirty-five for August.

The feature of the third period is the drop of 213.8 or 43.8% in absenteeism from sickness and 18 or 12.7% less from accident.

The reduction in the total absences being 231 or 36.8%.

In the fourth period, embracing ten months of the reversion to the forty-eight hours week there was a great increase on the previous period approximating the totals and rates of sickness and accident for the year preceding the introduction of the forty-four hours week.

The totals both of sickness and accident are higher than in any of the previous periods, whilst the rates also are higher than for the two periods of reduced hours.

The rate of sickness increased 168 per thousand employees or 71%, that of accidents 9.6 or 7.7%, the increase in the total being 176.8 or 44.4%.

The amount paid by the City Council for sickness and accident was *per capita* 96s. in 1920, 112s. 7d. in 1921, 83s. 3d. in 1922 and 77s. 6d. for the first nine months of the present year.

One of the largest munition factories in England during the war, employing 70,000 workers, gave its employees a whole holiday on Saturday instead of a half day, owing

to numerous absences from work. As a result, the absences were diminished by 50% and the firm has continued the innovation.

Avoiding Overtime.

If the day's work stops just short of undue fatigue, overtime means overwork. Overtime work is apt to result in an increased amount of spoiled work and in lessened output, as well as in an increased number of absences on subsequent days and is consequently unprofitable, particularly in view of the increased rate of wages that must be paid.

It has been recorded by me that where, owing to certain circumstances, it has been necessary for men to work considerable amounts of overtime and in some cases to do double shifts, especially in the Electricity Department, there have been an unusual number of cases of neurasthenia and gastritis, especially in the summer months.

In some cases men were absent through sickness, largely the result of over-fatigue, treble and quadruple the time they worked overtime. Overtime should only be resorted to in exceptional emergencies and even then not for many days in succession.

Alternating Day and Night Work.

In the Cleansing Department of the City Council it was found to be advisable to change men on the night shift periodically to day work, to reduce absenteeism through neurasthenia, gastritis and bronchitis, especially among the sweepers.

In the Electricity Department, however, it was found that there was less sickness actually among the men employed at night in the power house than among those employed during the day. In the case of other workers in the Electricity Department, only one weekly shift per month is worked from 11 p.m. to 7 a.m.

Mr. Perdriau, Inspector of Factories, New South Wales, referring to the individual loss of the worker, takes the case of labourer earning the basic wage of £3 19s. per week temporarily disabled. His income is reduced to 66.6%, that is £2 12s. 8d. a week, so that the net loss during a year's incapacity is £68 9s. 4d. The State's loss is not only that of a producing unit, diminished purchasing power of that unit, but often the direct charge through institutional treatment.

The capitalized value of a man of twenty-five has been estimated at £5,000. Much attention is now given to the prevention of accidents by the safety first movement.

In one establishment in England a safety committee was able to report a reduction of 50% in accidents after a year's work and a further drop of 12% for the next year.

There is one matter that this conference could help and that is to draw the attention of the large industrial insurance companies to the advisability of establishing orthopædic clinics in each of our large centres, as a reduction of the period of incapacity would mean a considerable reduction in the cost of accidents.

MALARIA IN AUSTRALIA.

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When this paper was first written, the only review of malaria in Australia was a paper published by Cleland in 1914, which dealt with all accessible references to the subject up to and including 1912. Previous to the opening of Congress, however, there appeared an article by Maplestone (1923) which was intended to continue this review of the literature from 1912 to the present date. Unfortunately, since Maplestone's departure from Australia so much new information has come forward through the malaria survey carried out in conjunction with the Hookworm Campaign (representing the Commonwealth of Australia, the State of Queensland and the International Health Board) that the facts of his paper were already obsolete when published and the sole feature which remains comparatively established is that malaria is practically non-existent in Australia south of the 19th parallel of south latitude. This fact has never been seriously questioned. The facts set out below are based not upon the examination of official figures, but upon actual surveys of the areas implicated.

Certain occasional cases of locally-acquired malaria have been reported from the southern States and are of considerable interest since they indicate that in areas as yet malaria-free there are conditions occasionally suitable to the conveyance and spread of the disease.

The cases recorded, most of which are mentioned by Maplestone, have been kindly collected for me by Dr. Eustace W. Ferguson of the Bureau of Microbiology, Sydney. They include:

(1) A case at Gosford, near Sydney, New South Wales (S. Jamieson, The Medical Journal of Australia, February 20, 1915, page 168).

(2) A case reported to have been contracted at Wyong, New South Wales, but which was actually acquired in Sydney (Wilfred Evans, The Medical Journal of Australia, December 20, 1919, page 526). A further account of the case appears in the Annual Report of the Bureau of Microbiology, Sydney 1919.

(3) A case at Rosewood, which is twenty miles from Tumbarumba, New South Wales (H. Clayton, The Medical Journal of Australia, May 7, 1921, page 382).

(4) A case at Barraba, New South Wales, reported in a note to No. 3.

(5) A case at Forbes, New South Wales, reported in a note to No. 3 though in this last instance, the evidence of malaria is insufficiently authenticated.

(6) A case at St. Arnaud, Victoria (Gerald Doyle, The Medical Journal of Australia, May 21, 1921, page 421).

(7) A case at Perth, Western Australia.

These cases may be looked upon as unimportant to the broader aspect of malarial distribution. As regards endemic malaria and the rare epidemic malaria, however, there is a considerable mass of important evidence which was apparently inaccessible to Maplestone.

The first medical description of malaria is said by Cleland to have been that of White (1867) who described the

fevers of the Gulf of Carpentaria, Queensland. Though other fevers are confused with it, there is no doubt whatever, that definite malaria is included in this description.

In the early days of a new country, especially when mining is the great stimulus to immigration and road and railway making a considerable feature of progressive activity, malaria is almost certain to be introduced if circumstances favour such an occurrence. There is little reason to doubt, therefore, that as Cleland (1914) states there was extensive and severe malaria in North Queensland for some years prior to 1885, nor to question the substantial accuracy of the reports of Ahearne (1890) for Townsville, Hunt (1890) for Hughenden and James (1891) for Croydon. Hunt may have confused typhoid fever and malaria, but James certainly described malaria and the disease is still mildly endemic in Croydon, the locality mentioned.

With regard to Ahearne's cases the emphasis is placed not upon Townsville, but upon the northern district for which it was the centre. In conversation Ahearne recently stated to the writer that from 1880 to 1885 malaria was prevalent to a very extensive degree among the scrub cutters on the rivers between Townsville and Cairns. He believed that the early cases of the disease were introduced, but definite areas of endemicity were later established between 18° to 19° S., where, as a matter of fact, they still persist.

The same history is applicable to all the mining areas and the rushes that accompanied their opening up. There is the same initial epidemic, the same decrease in the disease as the nomadic population followed elusive Fortune elsewhere and the same persistence of a mild endemic malaria tending more and more definitely to restrict itself as population dwindled.

At the present date the distribution of malaria may be described from several endemic centres. In North Queensland the disease exists in the coastal areas from Ingham and Cardwell 19° S. to Batavia Gold Diggings at the extreme north of Cape York Peninsula, throughout the Peninsula itself and along the whole eastern and south eastern coasts of the Gulf of Carpentaria. In the Northern Territory three main foci extend from Avon Downs near the Queensland border (19° S.) to Roper River in the east and Victoria Downs in the west at the coastal junction of the boundaries of the Northern Territory and Western Australia. These centres converge upon Pine Creek and ultimately on Port Darwin, in which latter locality the disease, however, does not appear to be endemic according to records. In Western Australia there are said to be centres along the Fitzroy and Ord Rivers at Broome and at Derby, but this is insufficiently substantiated.

An examination was made of all the areas mentioned above with a view to establishing the position so far as malaria was concerned. In Western Australia the general disrepute of the areas regarded as centres of malarial endemicity was not borne out by actual observation. The town of Derby in particular is characterized by a sandy soil, a high evaporation rate and a scanty rainfall, which do not suggest that the continuance of malaria is favoured. Anopheline mosquitoes are, moreover, rare. This observation is not, however, applicable generally in the northern parts of Western Australia and it is probable that malarial cases do occur sporadically in the riverine districts of the Rivers Fitzroy and Ord. The proximity of the latter to the infected area of Victoria River Downs immediately across the Northern Territory border renders this possibility more probable.

In the Northern Territory itself, as has been stated, malaria has a tri-radiate distribution. The most westerly area involved is that along the Victoria River. During 1920 and 1921 six deaths occurred at Victoria River Downs and cases were reported from Willeroo, Delamere, Wave Hill and Victoria River Downs which are stations situated along the area drained by the Victoria River. Parasites were obtained from the blood in several patients. Avon Downs in the south east and Roper River on the western shores of the Gulf of Carpentaria are also held in a disrepute which is confirmed by occasional deaths. Certain of these patients have presented the parasites of malignant tertain. The trunk railway from Port Darwin towards Daly Waters is marked along its whole course by the occurrence of sporadic cases of malarial fever. Brook's Creek, Pine Creek and Katherine are all affected.

Baldwin and Cooling (1922) reported finding three cases of malignant tertian malaria and one of benign tertian in white persons at Darwin. One patient who died was aged fifty and came from Brock's Creek. Of the other two persons with malignant tertian, one was aged forty-seven and came from Katherine, the other was aged thirty and came from Pine Creek. The person having benign tertian was a woman aged thirty-two living in Darwin, who had previously had malaria at Mt. Bonnie. They found at Marranboy histories of malaria in two individuals who had been in the Territory for eleven and for three years respectively. At Pine Creek three white adults had splenic enlargement and a definite history of having had malaria many times. At Emungalen six whites examined (four adults and two children) gave histories of having had malaria. In examinations for splenic enlargement amongst the aboriginals in the Darwin compound, thirty-six of one hundred and fifty-nine full-blooded aboriginals (22.6%) showed a splenic enlargement. Seventeen of fifty-four half castes or 31.5% showed a splenic enlargement. Of the fifty-three aboriginals showing an enlarged spleen the table gives particulars concerning forty-nine.

Naturally, the figures shown here cannot be taken as definite indication of malaria in the localities mentioned. The very fact of the natives being at Port Darwin indicates that they are wanderers who may have picked up their disease anywhere in the Northern Territory, and moreover their numbers are too small to have any great significance. They indicate, however, that malaria is probably endemic to a slight degree over a wide area in the Northern Territory and the facts recorded above, meagre as they are in numbers, have considerable significance when related to the scanty white population and the considerable morbidity rate when expressed in percentages.

In Queensland although cases are more frequent, the distribution of the disease is more definitely restricted. The old cattle routes which were probably the great disseminators of malaria in the old days, led south-east from

TABLE I.

Tribe or Origin	Number Examined	Number with Enlarged Spleen	Percentage with Enlarged Spleen
Wangite	51	7	13.7
Melville Island	33	6	18.2
Larray Keyah	32	9	28.1
Bathurst Island	18	7	38.9
Pine Creek	12	2	16.7
Marungana	9	2	22.2
Darwin	7	3	42.9
Daly River	6	1	16.7
Wave Hill	6	3	50.0
Paper Bark	4	2	50.0
Katherine	4	1	25.0
Adelaide River	3	1	33.3
Roper River	3	2	66.0
May River	3	1	33.3
Willoroo	2	1	50.0
Borroloola	2	1	50.0
All Sources	195	49	24.5

the Northern Territory and the infected Roper River district to Burketown and then directly south to Kajabbi Junction and onward. It will be recollected that Burketown was, on one occasion at least, afflicted with an extremely fatal form of pernicious malaria, leading to the abandonment of the town site. At one time Turn-off Lagoons between Burketown and Kajabbi Junction was regarded to be a considerable focus for infection. In both localities, however, a considerable reduction in population and communication has resulted in a very great decrease in the reported cases. This same factor operates throughout the whole of this country where the practical cessation of mining and the great reduction in cattle raising has brought about a very considerable change. As one proceeds further eastward the Government Station at Van Rook is reached. Van Rook, Delta and Stirling Stations represent an endemic focus for the disease where cases of a subtertian nature occasionally occur. The consensus of opinion in these areas is that the malaria of the present day differs in type from the malaria of twenty or thirty years ago.

Descriptions seem to indicate without doubt that this earlier form was benign tertian with definite ague. The present subtertian form appears to have been introduced later and is tending naturally to decrease. The absence of ague, however, leads to the local opinion that the disease is not malaria.

Proceeding northwards along the western side of Cape York Peninsula, malaria occurs frequently at the mission stations of Mapoon, Weipa and Aurukun. At the Batavia Gold Diggings in the extreme north the first outbreak of malaria is reputed to have occurred in 1901 and it is said there have since been sporadic cases annually "particularly when new land is opened up." A similar history attached to the workings at Coen and Tin Creek. Reports from the inland telegraph stations of the Peninsula indicate the sporadic occurrence of the disease with an occasionally fatal result at McDonnell, Moreton, Pascoe River, Merluna, Mein, York Downs, Moojeeba, Kbagoola, Yarraden, Musgrave, Munburra Gold Diggings (Starcke River), Roseville, Maytown and Bloomfield. Continuing further south the Yarrabah Mission between False Cape and the Russell River harbours occasional infections. Further south again we reach Cairns to which reference has been made, and continue along the Mulgrave Valley to Innisfail and Mourilyan. At the last named place and along the Johnston River cases of malaria are by no means rare. Further south again Ingham is reached eighty miles north of Townsville. Here the population contains a considerable proportion of Italians, many of whom bring infection from their own land. This is the furthest south point at which malaria is frequent and it was stated to the writer that cases have increased considerably in number of recent years.

As regards the carrier of malaria in Australia, the probabilities lie between *Anopheles* (*Nyssorhynchus*) *annulipes* and *Anopheles* (*Myzorhynchus*) *bancrofti*. Of these *Anopheles annulipes* has generally been hypotheticated as the vector. It has been pointed out by various writers that there is as yet no justification for this assumption other than the fact that *annulipes* is the only common mosquito in regions where malaria is prevalent and in some localities, as for example on the Roper River, exists in enormous quantities and is the sole species found.

Anopheles bancrofti does not occur south of Brisbane so far as our present knowledge goes, nor is it found in those localities where sporadic cases of locally-acquired malaria have been reported, as in New South Wales, Victoria and southern Western Australia.

THE PROPHYLAXIS OF MALARIA AS APPLICABLE TO THE NAVAL SERVICE IN TIME OF WAR.

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In submitting to your patient attention this paper on "The Prophylaxis of Malaria, as applicable to Naval Service in time of War," I trust that I may be able to convey to you some idea of how a Naval medical officer would attempt the solution of this problem and that your criticism and discussion may bring out any points that I have omitted.

In the ship the medical officer's chief efforts will be directed towards excluding mosquitoes from the ship. Only when they come on board need he carry out any direct attack on the definitive hosts of the malaria parasites.

The first precaution lies in anchoring off shore. A "mosquito guard" of six or eight responsible men should keep a look-out for mosquitoes and as soon as any appear in the ship, a move further out must be made. Native boats, especially those that have awnings or are decked or contain vegetables or fruit, should be made to stand off as far as possible. Ship's boats running to the beach should be kept open to air and sun. Vegetables and fruit or any damp or loosely packed gear that may harbour mosquitoes should be turned over on shore to disturb and drive off any mosquitoes therein.

Where it is necessary to anchor close inshore, the ship is made as mosquito proof as possible.

Light metal or wooden frames covered with metal gauze (preferably copper, six or seven strands to the centimetre) or strong, close mesh cotton net are adapted to all skylights, gun ports, scuttles and the less frequently used hatches. Where passage-way must be left, doors or hatch covers with spring hinges or a weight and pulley attachment are fitted. Scuttles may be secured with gauze wired or soldered to the inboard end of air scoops or applied to light metal or wood frames with lugs or clips for attachment to the scuttle screws.

Behind this system of screening the ship's company retires at nightfall. Boat's crews, signalmen and any ratings required on the upper deck wear thick clothing, boots, gaiters, leather gloves with gauntlets and helmets with a deep veil of netting hanging from the brim. As few lights as possible are to be burnt as they attract all flying insects.

Oil of citronella purchased in bulk is cheap enough to justify its use and it is a good deterrent of mosquitoes. Such fumigants as "joss sticks," incense and "Lotol" (a proprietary spray) are useful, but afford an incomplete protection. None of these deterrents can replace fine mesh, well adjusted netting.

All mosquito harbourage in the ship must be obliterated. All fresh and brackish water accessible to mosquitoes must be found and got rid of; any place where it may collect is to be drained or filled in.

When there are both mosquitoes and malaria patients in the ship the latter should be isolated in a special netted in mess during the hours between sunset and sunrise. Entrance to the "malaria mess" is to be through spring doors opening outward or, better still, through double doors forming a "lock." The mess should be fumigated twice a week with formaldehyde to kill any mosquitoes that may be within.

When difficulty is experienced in excluding or destroying mosquitoes, quinine prophylaxis must be considered.

An effective dosage is 0.6 or 1.0 gramme (ten or fifteen grains) of the bi-hydrochloride daily in solution. It is best given in a single dose during the "dog" watches, that is after the day's work and an hour or so before turning in.

The problem of effectively protecting landing parties is the most difficult of all.

Landing with none but the most portable gear the medical officer has no more effective means of protecting his men than is afforded by quinine. Oil of citronella or the pungent smoke of manure "smudge" fires may afford some protection and, if transport facilities permit, cotton mosquito netting may be used, either as individual nets or as lining to tents or huts.

When there is time to prepare tents or similar shelters, the curtains or walls of such may be fitted with toggles and beckets or hooks and eyes, to permit of their being turned up; then are adjusted, on the inside, curtains of net in such a manner that they may be lowered and pinned to the ground. The netting should stop seven and a half or ten centimetres (three or four inches) from the ground level and be replaced by fifteen or twenty centimetres of strong calico, giving sufficient slack of the latter to insure its settling on the uneven ground. The doorways should have well fitted curtains with a calico zone at the bottom.

More prolonged land operations call for a display of the naval medical officer's best knowledge of civil engineering. In such circumstances there is more time to organize working parties, requisition tools and carry out malaria surveys. The more permanent camps may, therefore, be protected to a considerable extent, often absolutely, by a well organized anti-malaria campaign.

Landing on a coast of which the malarial potentialities are unknown to him, the medical officer must proceed to interrogate the local residents, especially government officials, and make a survey of the hosts, both human and mosquito, of the malaria parasites. Having decided that malaria exists, he must seek the best camp site available and compatible with the strategic requirements of the operations contemplated.

Sites to be avoided are those in proximity to larva or adult mosquito harbourage that is not amenable to easy clearing or drainage. Positions where the level of the sub-soil water is within sixty centimetres (two feet) of the surface. Any exposed position.

On coming ashore in medical charge of a landing party the surgeon will for the time being use such prophylactic measures as are immediately available, namely mosquito nets, citronella, smudge fires of manure and quinine prophylaxis. When the camp is free of mosquitoes, he may reduce or abolish these precautions.

His first consideration will be his water supply. The most satisfactory source is from clean wells or the centres of clear running streams of larger lagoons. In the case of wells a layer of kerosene on the top will not impart any appreciable taste to the water pumped from beneath it. Care must be taken that crude oil used in treating undrainable collections of water does not gain access to the drinking water. Where water is stored, it is covered with a layer of kerosene or the tanks' openings stopped with a gauze cover.

Now commences the real work of combating the mosquito. This is effected mainly by spraying, clearing and draining operations. As immediate results are desired, an extensive use of the spray is advised. Later this will give way to the more permanent and economic methods of clearing and draining; in fact, the oiling will not be really effective till the removal of weeds, rushes *et cetera* permits an even spread of the oil over the surface of the water. The oil generally advocated is a mixture of fuel oil and a low grade paraffin. The proportions vary with the temperature and must be ascertained by experiment. An efficient spraying mixture should spread quickly and form an even film on the surface of the water.

The only means of using oil applicable to service conditions are the drip can and the spray. The drip can is useful for oiling the surface of a stream, but is rather uneven in its distribution of the oil. The spray is much more efficient and can be carried out effectively with so simple an instrument as the brass garden syringe used by suburban horticulturists. More elaborate equipment is to be had, of which the knapsack pattern with over head (not side) lever is the best. Whatever type of sprayer is used attention must be paid to the valves and washers which should be of leather, as rubber perishes in contact with oil.

In spraying a strip of ground sixty centimetres (two

feet) back or thirty centimetres up from the margin should be treated as well as the surface of the water. This kills vegetation along the borders of the pool or channel; it cleans up the margins as well as gives an indication of the efficiency of the spraying party. The amount of oil used and the frequency of the sprayings vary greatly and must be controlled by observation. An average estimate is 1,635 square centimetres with one litre of oil, treated once a week. A good test of efficient spraying is got when the filamentous algæ of the unoiled water is replaced by a slime of felted algæ, which latter appears to be intolerable to mosquito larvae.

Local inhabitants will probably resist any attempt to oil their irrigation ditches or rice fields and must be handled with tact. In carrying out this work it will be found that, whilst a thick film of oil creeps up and destroys plants growing in water, a thin film does not do so. The best means of broadcasting oil over a rice field is to scatter oil-impregnated sawdust throughout the field, but this is hardly applicable to service conditions.

The *terrain* having been made tenable by temporary measures, more permanent means should be adopted. Working from the centre of the camp area outwards, in order to get the immediate benefit of the work done, clearing is carried out and followed quickly by draining.

The desired area, that is the camp site and a half mile zone surrounding it, is cleared of all brushwood and long grass; most of the trees are felled or ringbarked. If grass or scrub can be fired with safety, time may thus be saved. Trees standing by themselves, especially if their foliage be not too thick, may be left. Groves of leafy trees may harbour mosquitoes or provide zones of still air along which the latter may travel, but trees set out in orderly rows, as in an orchard and especially if they are well pruned, rarely shelter mosquitoes. Along the courses of streams and the edges of ponds and the like the clearing must be very thorough and it may be found most profitable to grub out all aquatic plants growing there.

Native huts within the area to be cleared should be pulled down or burned, even if this course entails the payment of compensation or the provision of other shelters. It is practically impossible to carry out prophylactic measures successfully amongst ignorant people who have developed a fatalistic attitude towards disease.

Almost step for step with the clearing operations the work of draining the camp is carried out. The objective is the removal of all fresh and in some localities and with certain mosquitoes brackish water that is not required for the use of man. Where removal is impracticable, the water is concentrated in the larger streams and pools where it can be oiled.

Water required for the camp is conserved in clean wells or tanks and protected by a layer of kerosene or gauze. That which is required for animals should be drawn from protected wells or from the larger streams or lakes. Animals are not to be allowed indiscriminate approach to their water supplies as their hoofs break down the banks, making boggy patches difficult to treat and favourable to the breeding of mosquitoes; also their dejecta defiles the water. Where possible all beasts required for food or transport should be watered at troughs on firm ground easily drained or at definite watering places wired off from the rest of the stream or lagoon. This watering place should have a firm, preferably shingle, margin and bottom and a fairly steep slope (say one in four).

Irrigation fields are very difficult to treat, as permanent drainage is incompatible with the function of the field. Any success to be achieved will be through intermittent flooding. This entails a close study of the breeding habits of the local mosquitoes and is not applicable where anophelines breed throughout the year. Water is run on to the field and left for six days, no longer; then it is ran off and the fields allowed to drain for eight days before reflooding. To permit effective flooding and draining the water channels must have an adequate fall and be kept clear and in good working order. On the whole the difficulties of dealing with irrigation fields are so great that, where it is impossible to avoid camping near such fields, it is probably more satisfactory to evict the peasantry and pay such compensation as is necessary.

THE ACTIVITIES OF THE AUSTRALIAN HOOKWORM CAMPAIGN.

By W. C. Sweet, M.D.,
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The history of hookworm control work in Australia and its dependencies has been covered by articles written by Drs. Waite, Sawyer and Sweet, which appeared in The Medical Journal of Australia and in Health (1), (2), (3), (4). These articles summarized the history of hookworm disease in Australia, reported on the results of the early surveys in Papua and Queensland and gave interim reports on the work of the Australian Hookworm Campaign.

The Hookworm Campaign began work on October 1, 1919, with objects which were summed up as follows:

(1) To map Australia and its dependencies with regard to hookworm disease and to carry on control operations where the disease was found.

(2) To devise and institute practical and economical methods for the permanent control of the disease.

These objects have been largely attained.

Mapping Australia and Its Dependencies and Carrying on Control Operations.

The survey of Australia and its dependencies for the purpose of finding out where hookworm disease existed was done by various methods. In the survey method certain representative groups of people in different occupations and age groups were examined for hookworm disease and those found infected were treated with oil of chenopodium. This method was used in parts of Queensland and for all the other States and territories. It was early found that the school children were the most available group for survey purposes and that, by examining them, it was possible to ascertain the hookworm conditions in the area. In the intensive method, used in parts of Queensland, certain definite infected areas received a thorough house-to-house canvass and everyone in these areas who was willing, was examined and treated if found infected. Some occupations and institutions required

particular attention and this was usually given by a modified intensive method. This was used in some of the mining fields and in orphanages, hospitals for the insane and other institutions. By these methods the original survey of Australia and its dependencies was completed about December 31, 1922. Table I. gives the results of the original survey by States and Territories. Many of those treated were not re-examined, so the 8,535 persons listed as being cured do not at all represent the actual number.

TABLE I.

HOOKWORM DISEASE IN AUSTRALIA AND ITS DEPENDENCIES —FIRST SURVEY.

State	Number of Persons Examined	Number Infected with Hookworms	Percentage Infected	Number of Persons Treated	Number of Persons Microscopically Cured
Victoria	2,497	0	0.0	—	—
S. Australia	3,281	0	0.0	—	—
Tasmania	2,209	2	0.1	2	0
W. Australia	2,846	308	10.8	225	0
N. Territory	886	148	16.7	148	21
N. S. Wales	23,573	774	3.3	596	441
Queensland	167,290	15,472	9.2	14,909	8,041
Papua	17,905	10,601	59.2	8,776	32
New Guinea	28,234	20,951	74.2	8,593	0
Totals	248,721	48,256	19.4	33,249	8,535

It seemed safe to conclude from these results given in Table I. that there was no hookworm disease problem in Victoria, South Australia or Tasmania. Their climate is such that it is highly improbable that a hookworm problem will ever exist.

The hookworm problem in Western Australia is chiefly confined to the coastal aborigines in and around Beagle Bay, eighty-four miles north of Broome, and to such whites as are in intimate contact with them. The amount and sources of infection are not so great but that the State itself can cope with them. Control measures were undertaken by the State Health Department after the Hookworm Campaign's survey and it is not likely that further outside assistance will be necessary unless conditions change considerably.

There were 886 persons examined in the Northern Territory and 148 or 16.7% were found to be infected with hookworms. An analysis of these infections showed that all but a few were acquired in the extreme northern part of the Territory where the rainfall is over 127 centimetres (50 inches) and on islands off the coast. The hookworm problem in the Northern Territory is concerned mostly with aborigines and is within possible control by the Administration. It is probable that yearly mass treatments of aborigines in and around Darwin would reduce the incidence of hookworm disease to a considerable degree.

In New South Wales 23,573 persons were examined and 774 were found to be infected with hookworms. This is an incidence rate of 3.3% The distribution of these infections is given in Table II

TABLE II.

HOOKWORM INFECTIONS IN NEW SOUTH WALES.

District	Number of Persons Examined	Number Infected with Hookworms	Percentage Infected
Broken Hill	4,008	0	0.0
Newcastle			
School Children	3,066	0	0.0
Coal Miners	1,224	5	0.4
Bull-Lithgow Coal Miners	1,603	4	0.2
Murrumbidgee Irrigation Area	672	0	0.0
Northern Rivers District			
School Children	8,602	379	4.4
Miscellaneous	4,398	386	8.7
Total	23,573	774	3.3

In the Northern Rivers District, a coastal strip about one hundred kilometres (sixty-two miles) wide extending from the Tweed River in the north to the Myall Lakes just north of Newcastle in the south, 8,602 school children were examined and 379 or 4.4% were found to have hookworm disease. This infection was heaviest in the Tweed River Area and in the Bellinger-Nambucca Area.

There were 167,290 persons examined during the first survey of Queensland. Of this number 15,472 or 9.2% were found to be infected with hookworms. Most of the coastal portion of Queensland was surveyed by the intensive method, while the part west of the main coastal range was covered by rapid surveys. An analysis of the persons found infected showed that Queensland had an endemic hookworm area which comprised all of the Cape York Peninsula and a coastal strip averaging about one hundred kilometres wide from Cooktown to the Tweed River. Certain portions of this strip are lightly infected and two "islands" of non-endemic area, around Brisbane and Rockhampton, were found. Another "island," in which infection was almost absent, was around Ayr. The bulk of the non-endemic area was found to lie between the Gilbert River and the southern border of the State and between the main coastal range and the western border. Table III. gives the distribution of hookworm disease in Queensland.

The Australian Hookworm Campaign's surveys of Papua and New Guinea were made in 1920 and 1921 respectively by Dr. S. M. Lambert. These surveys covered representative parts of both territories and gave an infection rate of 59.2% for Papua and 74.2% for New Guinea. Where infection with hookworms is found in as large a proportion of the population as these figures indicate, mass treatments may be given to advantage. Under the mass treatment plan the whole population is given a treatment at stated intervals without previous examination. This plan was adopted in both Papua and New Guinea and 178,973 treatments were given in the first year and a half of this work, at a cost of about threepence a treatment.

TABLE III.

HOOKWORM INFECTIONS IN QUEENSLAND.

Area	Number of Persons Examined	Number Infected with Hookworms	Percentage Infected
Endemic Hookworm Area	130,833	14,067	10.7
Non-endemic Hookworm Areas	32,116	389	1.2
Endemic Coal Mines	1,341	517	38.5
Endemic Institutions in non-endemic areas	3,000	499	16.6
Totals	167,290	15,472	9.2

Relation of Hookworm Disease to Rainfall and Age.

Certain factors influencing the prevalence of hookworm disease were noted during the first survey of Australia. The most striking of these was the relation between rainfall and hookworm incidence and the distribution of hookworm disease in the various age groups.

In areas where the rainfall is above 114 centimetres (45 inches) *per annum* hookworm disease is usually endemic; in areas with a smaller annual rainfall there is little or no endemic hookworm disease. Other climatic conditions have their influence and the hookworm egg needs warmth as well as moisture in order to complete its development. No endemic hookworm disease was found south of the 32° south latitude, regardless of rainfall conditions.

In countries where hookworm disease is found amongst a native population which goes barefooted, the highest incidence rate is found in the adult group between the ages of nineteen and forty years, the most active years of life. This is not true among Australian whites. Here the only age-group which is fairly consistently barefooted, is the school age-group from six to eighteen years of age and this is the group which has the highest infection rate. After the latter age the Australian is likely to wear shoes and lose the hookworm infection acquired during his barefooted youth. This age distribution is shown in Table IV. and is contrasted with the distribution found amongst the aborigines who go barefooted through life.

TABLE IV.

DISTRIBUTION OF HOOKWORM INFECTION BY AGE-GROUPS IN WHITES AND ABORIGINES, IN SOME OF THE INTENSIVELY SURVEYED QUEENSLAND DISTRICTS.

Age (Group years)	Examination	White Race	Aborigines
0 to 5	Examined	7,064	320
	Infected	768	155
	Percentage	10.9	48.4
6 to 18	Examined	15,164	901
	Infected	3,380	437
	Percentage	22.3	48.5
19 to 40	Examined	14,532	1,176
	Infected	1,519	646
	Percentage	10.4	54.9
41 to 60	Examined	6,331	320
	Infected	392	170
	Percentage	6.2	53.1
Over 60	Examined	1.294	47
	Infected	34	22
	Percentage	2.6	46.8
Total	Examined	44,385	2,764
	Infected	6,093	1,430
	Percentage	13.7	51.7

Devising Practical and Economical Methods for the Permanent Control of Hookworm Disease.

To follow up the first general survey and treatment campaign, it became necessary to devise some method of work which would be suitable for permanent adoption and would be inexpensive.

Dr. Sawyer's scheme provided for various combinations of intensive and school survey methods according to the percentage infection rate established by the previous survey. This percentage infection rate of the whole population of a district was referred to as the "hookworm index." With these field methods there was to be as much publicity and popular education as possible, with special emphasis on the prevention of soil pollution as the surest method of controlling hookworm disease. This plan was put into effect on January 1, 1923, and has now been in operation for ten months. The results have exceeded expectations. The plan has proved economical in both time and money and has been highly efficient in measuring the control of hookworm disease already attained.

TABLE V.

COMPARISON OF HOOKWORM INDICES IN PLACES COMPLETELY RE-SURVEYED BEFORE SEPTEMBER 1, 1923.

Place	Last Hookworm Index	Previous Hookworm Index	Improvement	Loss
Intensive Resurveys				
Mackay District	7.9	15.5	7.6	—
Cardwell District	24.2	30.2	6.0	—
Ingham District	17.8	18.1	0.3	—
Nambour District	5.3	9.4	4.1	—
Cooktown District	23.9	33.7	9.8	—
Proserpine Area	6.9	8.6	1.7	—
Purga Aboriginal Mission	70.4	45.9	—	24.5
Palm Island Aborigines	66.2	56.9	—	9.3
Ipswich Coal Miners	6.1	31.5	25.4	—
Townsville Orphanage	48.0	43.4	—	4.6
Barambah Aboriginal Station	4.7	25.0	20.3	—
Stradbroke Island	9.2	4.2	—	5.0
Hospital for Insane, Goodna	7.5	23.4	15.9	—
School Resurveys				
Southport District	1.2	3.1	1.9	—
Proserpine Area	8.6	13.7	5.1	—
Bowen Area	0.6	2.1	1.5	—
Ayr District	1.2	1.8	0.6	—
Townsville District	1.9	3.4	1.5	—
Caboolture Area	0.7	2.7	2.0	—
Northern Rivers District of N. S. Wales	2.0	2.5	0.5	—

Results of Control Operations.

In the endemic districts of Queensland and New South Wales a treatment campaign and some efforts towards sanitary improvement went hand in hand with the original survey. The permanent control plan gave the opportunity to measure the results of this work. Table V. compares the last hookworm index of the districts resurveyed before this paper was written with the index of the original survey made by the Australian Hookworm Campaign.

Twenty places had been completely re-surveyed and of these twenty only four failed to show a lower hookworm index on re-survey than on the original survey.

Continuation of Hookworm Control Work.

The Hookworm Campaign recommends that the Commonwealth of Australia and the States of Queensland and New South Wales cooperate to continue the control measures which have shown such promise in the hands of the present organization. The new work could be based on the Commonwealth Health Department's diagnostic laboratories which are being established at strategic points throughout the area to be covered. With the two medical units and a sanitary unit, three more years of work should put the control of hookworm disease in such an advanced place that further changes in staff and budget could be made.

No disease is subject to control by sporadic or intermittent measures. The control of hookworm disease in Australia and its dependencies has been well begun and it is now essential that no opportunity for loss of control be given. Continued effort will greatly reduce the incidence of hookworm disease, the most important of the tropical diseases of Australia and will afford a shining example of what can be accomplished by intelligent, well-organized cooperation in making tropical countries healthy places in which to live.[1]

References.

(1) J. H. Waite, "Preliminary Report on Anchylostomiasis in Papua," The Medical Journal of Australia, September 15, 1917.

(2) J. H. Waite, "The Queensland Hookworm Campaign," The Medical Journal of Australia, December 21, 1918.

(3) W. A. Sawyer, "Hookworm in Australia," The Medical Journal of Australia, February 19, 1921.

(4) W. C. Sweet, "The Australian Hookworm Campaign," *Health*, Volume I., No. 6. June, 1923.

(5) Sawyer, W. A., "Some Directions in which Advances in Preventive Medicine Could be Made in Queensland," The Medical Journal of Australia, February 11. 1922.

[1] The complete article will appear in author's reprints.

SOME NOTES ON UNCLASSIFIED FEVERS OCCURRING IN THE NORTH QUEENSLAND COASTAL REGIONS.

By F. T. Wheatland, M.B., Ch.B.,
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In various places along the coast of north Queensland fevers occur, which up to the present time have not been classified. It is with the object of drawing attention to these that the following notes are written.

Coastal Fever.

In 1910, Smithson (1) first called attention to a specific fever occurring in the neighbourhood of a small town called Mossman, situated a few miles from Port Douglas in north Queensland.

In a report to the Commissioner of Public Health, Queensland, in 1913, Clarke (2) gave a very full and detailed account of his observations on a large number of cases of this fever. This report has largely been made use of in the compilation of these notes.

Smithson and Clarke both describe the fever under the name "Mossman Fever."

In 1914, Breinl, Priestley and Fielding (3), making use of Clarke's report, describe it under the name of "Endemic Glandular Fever."

The fever is not confined to the Mossman district. A similar disease occurs in several of the coastal towns in North Queensland. The disease will be referred to in this paper by the name by which it is usually spoken of in the affected district, namely Coastal Fever.

Definition.

Coastal fever is an acute endemic disease characterized by continued fever of about twenty-one days' duration, with pain in the head, back and legs, accompanied usually by the painless enlargement of certain groups of lymphatic glands and in some cases by a rash which may be macular or occasionally vesicular.

Aetiology.

The disease may attack persons of any age or of either sex. Clarke's youngest patient was aged three months and his oldest patient seventy-six years.

A very great majority of the patients are men working in the fields, especially those engaged in timber cutting and clearing land and cane cutting.

There is no racial immunity.

The fever may occur at any time of the year, but the period of maximum incidence is from about June to August.

The disease is not infectious, as people living in the same house as coastal fever patients, do not get the disease and nurses and hospital attendants looking after patients are never affected.

Considering that the disease occurs practically only amongst those working in the scrub where insects abound, that it is not infectious and that it is probably not water or food borne, it seems very probable that it is conveyed by an insect. There is no evidence to show what this insect is. Mosquitoes, sand flies and a small red mite which causes a condition known as "scrub itch," are all common in the scrub in the district in which the fever occurs.

Symptomatology.

As a rule the onset is gradual with malaise, headache and anorexia. A patient frequently continues working for several days at this stage. The symptoms become more and more severe as the disease progresses. Vomiting and dry retching may occur.

The temperature may rise suddenly or gradually and reaches its maximum in a few days. It remains high for about ten to fourteen days and then falls slowly by lysis. The pulse rate does not increase in proportion to the temperature.

Headache is severe as a rule and is generally frontal. There may be some degree of photophobia.

Pains in the back and limbs are complained of.

Sleeplessness is a prominent and troublesome feature of these cases. Pain in the throat on swallowing may be complained of.

The bowels are usually constipated, but occasionally diarrhœa may occur. The tongue is coated with a thick fur and later becomes dry and brown.

There is usually but not always some enlargement of lympathic glands.

The axillary, inguinal or sometimes the cervical glands become enlarged, hard and tender on deep pressure. They never suppurate and are not painful.

The liver is not enlarged and the spleen not palpable.

A blotchy macular rash may occur on the trunk arms and legs. It usually appears about the fourth day. It fades after four or five days and disappears without desquamation. Occasionally a vesicular rash may occur.

Profuse sweating occurs and there is a distinctive disagreeable odour given off from the skin.

There is no abdominal distension or tenderness.

Relapses may occur in any type of the fever.

Prognosis.

In most cases the prognosis is very good. Of 1,482 cases Clarke had a mortality of less than 1%. He states that in cases of the drowsy type and of the restless type with very severe and persistent headache the prognosis should be guarded. Patients may look extremely ill, but generally they recover.

Diagnosis.

Coastal fever has to be diagnosed from dengue, typhoid fever, bubonic plague and climatic bubo.

The severe pains in the back, bones and joints which are typical of dengue, do not occur in coastal fever. The pains which occur in the back and limbs in the latter disease are of a different and milder character.

The fever is of longer duration in coastal fever than in dengue.

Coastal fever is distinguished from typhoid fever by the absence of abdominal pain and distention. Perforation, hæmorrhage and sloughing do not occur in coastal fever and the spleen is not enlarged. Bacteriological examinations distinguish it from both typhoid fever and bubonic plague.

In climatic bubo severe constitutional symptoms are absent. Only the lymphatic glands of the groin become enlarged and may frequently suppurate.

Treatment.

The treatment is mainly symptomatic. Purgatives are necessary to combat the constipation. Early stimulation with strychnine and digitalis is strongly indicated.

Depressing drugs such as salicylates do harm.

Pathology.

Breinl, Priestley and Fielding examined the blood of a number of patients and found that the number of red blood corpuscles and the amount of hæmoglobin do not undergo any changes during the course of the disease.

They found the number of leucocytes increased during the first few days, but did not observe any extreme leucocytosis. The differential count showed an increase in the percentage of leucocytes only.

They cut sections of lymphatic glands from the groin and neck of patients and found the typical picture of acute lymphadenitis. No necrotic areas were seen.

They injected two monkeys and one guinea pig with about ten cubic centimetres of the peripheral blood of two patients who showed well developed symptoms of the disease. They observed a definite rise in temperature in the monkeys on the ninth day and tenth day respectively after inoculation. The lymphatic glands of the infected monkeys became slightly enlarged at the time of the onset of the pyrexia. Two control monkeys kept under the same conditions did not show any rise in temperature. The guinea pig did not react to the inoculation in any definite way.

Coastal fever is also common in the Innisfail district, but in this district the time of maximum incidence is about December.

In addition to this fever which lasts about three weeks there is another milder form which lasts about ten days. This may be a milder form of the same disease, but the opinion generally held by medical practitioners who have seen many cases, is that it is a separate disease.

Sarina or West Plane Creek Fever.

This fever is endemic in the area surrounding West Plane Creek near the township of Sarina. This township is situated a few miles inland from Mackay. The chief industry is sugar cane growing, the cane farms lying in the country at the foot of a range of hills through which the West Plane Creek and Middle Creek run. The cane after cutting is taken to the Plane Creek Mill in Sarina for crushing.

Seasonal Distribution.

Cases occur during the wet season from November to April.

Incidence.

Cases occur principally among males who are working in the fields. Females are very rarely affected and then only those who have been working in the fields. The disease affects men engaged in clearing and ploughing new ground and ground which has been cleared and has again been covered with scrub. Cane cutters are very rarely affected. One farm was pointed out on which there had never been a case of fever. It was stated that the men working on the farm never had their "crib" in the fields, but always returned to the house for it and washed their hands before eating. The owner of another farm had never had the disease, although several cases had occurred amongst the men working for him. He never ate while out in the fields, but always returned to the house and washed his hands.

It is the practice for men to take their drinking water out into the fields and not to drink the creek water, although in some cases men do the latter.

The land in the affected district, like that in surrounding districts, is thickly covered with lantana. There are very few birds' nests in the scrub. Rats and field mice appear to be plentiful in some parts, but not common in others. Rats are fairly common in the cane fields. Many

of the men working in the fields suffer from "scrub itch" caused by a small red mite, just visible to the naked eye. The prevalence of this scrub itch appears to bear no relation to the prevalence of the fever.

Definition.

Sarina fever is a continuous fever running a course of about the length of typhoid fever, but if anything somewhat shorter.

Symptoms.

The onset is more sudden than that of typhoid fever. There may be tiredness and malaise for a day or two. Sometimes the onset is sudden like dengue and with shivers.

Shivers may occur from time to time through the attack of fever. Mild cases present no very definite symptoms beyond fever and headache at the start. Headache is an early symptom and it hangs on longer than it does in typhoid fever. It may be very severe. It occurs behind the eyes.

The type of fever resembles that of typhoid with a gradual decline. Some cases show periods of greater remissions.

Delirium of a severe and noisy type frequently occurs.

Severe toxæmia with delirium, cyanosis, septic rashes and diarrhœa occurs in bad cases. These are fatal from heart failure earlier than in typhoid fever, sometimes in the second week. The heart seems not to respond to any stimulation.

Mild cases run an easy course to convalescence without much discomfort to the patient. The tongue is red and coated and becomes dry and brown.

Distension is not a common symptom. The spleen is seldom palpable. The rash is mottled, all over the body, but more marked on the chest and abdomen. A typical rose spot rash in crops is not observed.

The bowels are usually normal. In severe cases the patients sometimes get diarrhœa. They generally die. The stools are not like those of typhoid fever and may be brown and soft formed throughout.

Sloughs and hæmorrhage are very rare. Perforation has not been observed.

The lymphatic glands may or may not be enlarged. Some men who have treated patients with sarina fever state that they usually become enlarged early. Most often the inguinal glands are affected, but the cervical or axillary glands may also be enlarged. Other men say that they have never noticed any enlargement of the lymphatic glands.

No complications occur as a rule. Neuritis, periostitis or abscess formation do not occur.

Relapses do not occur. Second and third attacks may occur in succeeding years. These are generally milder in type. The mortality is about 20-30%.

Coastal Fever.

Onset gradual;
Rigors uncommon;
Constipation the rule;
May get relapses;
Heart responds to stimulation;
Mortality less than 1%.

Sarina Fever.

Onset sudden;
Rigors common;
Bowels usually normal, but may get diarrhœa;
No relapses;
Heart does not respond to stimulation;
Mortality 20-30%.

Conclusions.

There are two, probably more, unclassified fevers which occur in the coastal regions of north Queensland.

These fevers affect almost solely men working in amongst timber and scrub.

They are not infectious and are probably not water or food borne.

They are in all probability insect transmitted.

TAKE in References—9pt Solid

References.

(1) O. Smithson, "Mossman Fever," *The Journal of Tropical Medicine,* 1910, Volume XIII., 23, page 351.

(2) Clarke, "Annual Report of Commissioner of Public Health," Appendix E (1), Brisbane, 1913.

(3) A. Breinl, H. Priestley and J. W. Fielding, "On the occurrence and pathology of Endemic Glandular Fever, a specific fever occurring in the Mossman district of North Queensland," The Medical Journal of Australia, October 24, 1914, page 391.

BOWEL PARASITES OF AUSTRALIA AND HER DEPENDENCIES. THEIR RELATION TO DISEASE AND THEIR FREQUENCY OF OCCURRENCE.

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Bowel parasites may be considered under two headings: (i.) Helminthological parasites and (ii.) protozoological parasites.

Helminths.

The helminths infecting Australian inhabitants are as follows:

(1) *Trematoda*:

Schistosomum haematobium.

Affected soldiers have been treated with marked success, the majority being completely freed of infection while the remainder are still under observation. In north Australia a number of the Chinese and Japanese population have possibly brought with them the Oriental variety, *Schistosomum japonicum.*

Representatives of the mollusean hosts are found in Australia and there is no doubt that schistosomes can adapt themselves to the local species.

Clonorchis sinensis.

The Japanese liver fluke has been reported five times in Orientals in Australia, but there is little doubt they were infected before arrival, and its transmission to Europeans is highly improbable.

(2) *Cestoda.*

Taenia solium and *Taenia saginata* occur rarely, but no accurate details are available.

Diphyllobothrium latum has been recorded, but always

in persons previously resident in a known endemic country.

Hymenolepis nana occurs relatively frequently (0.2%) and may heavily infect aborigines, especially on mission stations.

Hymenolepsis diminuta is much rarer.

Cestodes rarely infect and still more rarely cause disease in Australia.

(3) *Nematoda.*

Ascaris lumbricoides is relatively infrequent in Australia, but Papua and New Guinea showed an incidence rate as high as 12%.

It may give rise to peritonitis, pleurisy and pneumonia.

Ankylostomum duodenale and *Necator americanus* occur relatively frequently (average 9% to 10%) from the northern rivers of New South Wales to Cape York, especially predominating along the coast. The average low number of worms harboured is in conformity with the infrequency of obvious clinical signs and symptoms.

Strongyloides stercoralis has a uniform incidence although a small one (0.25%). It is doubtful, however, whether this parasite can cause symptoms of any clinical importance.

Haemonehus contortus occurs in sheep and goats and probably in man on occasions.

Trichuris trichiura occurs infrequently in Southern Australia. The rate is up to 1% among whites in subtropical and tropical areas, up to 16% in asylums and aboriginal settlements, and 12.7% and 17.9% in Papua and New Guinea.

Enterobius vermicularis (*Oxyuris vermicularis*).

The vast majority of Australian children are infected at some stage of their existence, though often without causing definite pathological conditions.

Oxyuris incognita.

So far the parent worm has not been discovered. Evidence exists of a seasonal incidence, ova being most commonly found during the first quarter of the year.

Syphacea obvelata.

This is a common mouse oxyurid which occasionally infests man in other countries and may later be found in Australia.

Tyroglyphus longior, a common flour and cheese mite, is frequently found in stool examinations in Australia but is not known to cause any bowel condition of importance.

Protozoa.

Protozoological parasites are similar in variety to those found in the bowel of inhabitants of much more temperate countries.

Entamoeba histolytica.

Shearman's investigation points to endemic infection by this parasite.

The scarcity of outbreaks of amoebic dysentery is probably due to the lack of a suitable soil rather than to the absence of the causal agent.

Entamoeba coli occurs relatively frequently, but is of course non-pathogenic.

Endolimax nana, Iodamoeba biitschlii, Chilomastix mesnili and *Blastocystis hominis* have each been observed, but are non-pathogenic.

Lamblia (*Giardia*) *intestinalis* has been found, but opinion differs as to its pathogenicity. It may cause severe dysenteric symptoms.

Balantidium coli has been reported, but there are no authentic records. The parasite occurs in bowel of pigs in other countries.

One can readily conclude that *Entamoeba histolytica* is the one protozoological bowel parasite of importance yet discovered in Australia, which is of interest to the epidemiologist.

FILARIASIS IN AUSTRALIA.

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and
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In the section of tropical diseases it is particularly suitable that some reference should be made to filariasis and its distribution in Australia, since it was in Queensland (1876) that Dr. Joseph Bancroft first discovered the mature worm which Cobbold subsequently (1877) named in his honour *Filaria bancrofti.*

A review of the accessible literature offers little assistance in the attempt to map the distribution of filariasis in Australia. It has been long known in a more or less general way that the coastal areas of Queensland were affected and that in some places the endemicity rate reached a relatively high percentage. During the last twelve months, however, a filarial survey has been carried out in conjunction with the Australian Hookworm Campaign (representing the Commonwealth of Australia, the State of Queensland and the International Health Board) with a view to determining more fully those areas in which filariasis is constantly to be found, and certain interesting figures have been obtained which will be dealt with later in the paper.

The early history of filariasis in Australia, in so far as it appears in the literature accessible to the writers, consists almost entirely of reports of the cases and certain articles contributed to the *Australasian Medical Gazette* by Joseph Bancroft, T. L. Bancroft, Peter Bancroft, E. S. Jackson, Flynn, McLean and Croll. The Brisbane Hospital records which have been kept from the very early days of Queensland, naturally give no prominence to the records of elephantiasis and filariasis until subsequent to the date of Bancroft's discovery. From 1883 onwards, however, they are included under the heading "parasitic diseases" and in some areas a considerable number of cases are recorded.

In 1884 Scot Skirving described a successful operation for *elephantiasis scroti* from Camden, near Sydney, New South Wales, 33° S.. The case is interesting and the his-

tory deserves recording, more especially as filariasis does not now seem to occur in that locality.

The disease was found in a young man of twenty-four, whose parents had been born in New South Wales and who himself had been born in the Camden district, and had never been away from his home. At the age of six years he was operated upon and an enormously hypertrophied prepuce removed. His mother called the attention of the surgeon at that time to a slight thickening of the left leg just above the ankle. At the age of twelve he had a definitely enlarged scrotum with chyluria and suffered from attacks of filarial fever, the size of the tumour increasing after each febrile exacerbation. The enlargement of the scrotum and of the left leg and foot continued up to the date of operation at twenty-four years of age, at which time the tumour without its contained blood, weighed 21.3 kilograms (forty-seven pounds).

The first operation for *elephantiasis scroti* recorded from Brisbane is said by E. S. Jackson to have been seen by him in 1893. Previously the practice of injecting varices of the groin glands and similar lesions with iodine had been frequent and Jackson records on one such occasion an acute and alarming internal abdominal lymphangitis following this procedure.

Flynn, writing in 1903 from Ipswich, near Brisbane, stated he had seen approximately sixty cases of filariasis with clinical manifestations during the preceding five years and tabulated forty-seven of them thus:

Elephantiasis of one or both legs, seven cases (six in females); chyluria, nine cases (eight in males); and thirty other cases in males, comprising five of lymph scrotum, twelve of chylous ascites and thirteen of bilateral varicose lymph vessels in the groin.

In May, 1908, McLean, of Brisbane, drew attention to a great apparent increase in filaria in that locality. Whereas he stated between 1890 and 1900 the greatest annual total of cases in the large hospitals in South Queensland was twenty-one, the cases coming under consideration for the succeeding decade (1900 to 1910) in the Brisbane General Hospital alone varied between forty and sixty annually. In 1902 an examination of selected patients in surgical wards in Brisbane had shown that 15% were infested. In 1908 a three-monthly examination was made of the first two hundred patients consecutively entering the hospital each quarter. Of one thousand, two hundred thus actually examined one hundred and thirty or 10.8% were found to be infested and of these one hundred and ten came from Brisbane and its suburbs.

McLean stated that there were almost constantly patients with chyluria or lymph obstruction "lying for months in the hospital, deprived of the power of earning their own living and of providing for those dependent upon them."

At the same time various observers drew attention to the very considerably greater proportion of patients with "idiophatic hydrocele" operated upon in Brisbane, when the figures for that locality were compared with the numbers operated for this condition in any large southern hospital.

Croll, of Brisbane, later reported an incidence of 11.5% of filariasis in adults examined and of 5% in children in hospital. In children, he wrote, symptoms due to filariasis were very infrequent, the commonest being lymphangitis. Chyluria and lymph scrotum were rare and elephantiasis he had seen only once; but deep intra-muscular abscesses, thought to be due to filaria, were common.

Above Brisbane along the whole eastern coast sporadic information as to the incidence of filariasis has from time to time been brought forward. More definite information was obtained by a *questionnaire* addressed to medical practitioners resident in the coastal areas of Queensland and of northern New South Wales. From actual interviews with these doctors it was determined that a sporadic case or two had been seen in northern New South Wales at Lismore and in the Grafton district. Brisbane, of course, was recognized to be fairly heavily infected, as was also Ipswich. As one proceeded north along the coast filariasis was found to be recorded at Rockhampton, Mackay, Proserpine, Bowen, Ayr, Townsville, Ingham, Cairns, Port Douglas and indeed as far as Cape York, while an examination of the coast line of the Gulf of Carpentaria produced evidences of the disease at Normanton.

With regard to the investigations carried out in conjunction with the Australian Hookworm Campaign many factors contributed to render the actual total figures unsatisfactory in so far as the percentage of infestation goes, but useful from the point of view of determining the actual presence of the infection in certain localities where it had previously been recorded. For example, it was particularly difficult to obtain blood during the night except where schools, hospitals *et cetera* could be visited and blood taken from the inmates. In certain instances, however, these inmates were children whose infestation rate could not be taken to be that of the adult community. Other blood slides which were examined, were day slides which cannot be regarded as being of value in connexion with filariasis in Australia. Moreover, under any circumstances hospital patients must be regarded as a selected group and the general value of the findings qualified by that fact. Again, the slides were usually taken on one or two evenings at different periods of the year and it is well recognized that the filariasis rate, where only a few cases are likely to be found, may vary enormously owing to the variation in frequency of the parasite in the blood. It has indeed been our experience in Townsville that there is a seasonal variation in the prevalence of positive findings, the percentage dropping considerably in the winter. This observation was previously made by Flynn at Ipswich, South Queensland.

The results may be expressed as follows. In the Lismore area of northern New South Wales filaria was not detected and coupled with the histories obtainable from medical officers it is probable that the disease is only very mildly endemic, if it exists now at all.

In Brisbane where examinations in the hospital were carried on constantly, a percentage rate of 5.7 was obtained in 877 examinations of persons of both sexes and all ages.

Examinations at Ipswich showed an incidence of 3%.

In Maryborough a percentage rate of 2.5 was detected. Examinations, however, at the hospitals and schools at a later date increased the percentage to 4.6 and

the final figure for one hundred and five persons was 3.8%.

The examination of slides from Gympie did not reveal any infestation with filariasis, but this result is obtained from the examination of twenty-six slides only and, therefore, cannot be taken as conclusive.

At Bundaberg, of forty-three persons examined three or 7% showed filariasis, but only one of these infected persons had lived all his life in Bundaberg.

At Rockhampton an investigation was made and a percentage rate of 3 established. An inland survey as far as Longreach was carried out with the result that filariasis was found not to be endemic beyond the coastal areas.

At Mackay a considerable number of blood slides were taken, but only a few of these were obtained during the night. Filariasis was found to be endemic to a mild degree.

In the Proserpine and Bowen area an incidence varying between 3.5% for Proserpine and 1.5% for Bowen was determined.

At Ayr a percentage of 1.4 was determined.

The examinations in Townsville have been conducted at the General Hospital at two-monthly intervals with results in accordance with the following table.

TABLE I.

Date	Number Examined	Filaria Found	
		Number	Percentage
Dec. 12, 1922	45	4	9
Feb. 26, 1923	49	2	4
May 5, 1923	60	0	0
July 7, 1923	56	2	3.57
Aug. 27, 1923	61	2	3.29

It will be observed that during May (the coldest month) the percentage fell to zero. The infestation rate, therefore, was found to vary between the high and probably spurious total of 9% and the low and equally spurious total of nil. These totals in themselves indicate the absolute unreliability of the figures obtained in so far as percentages go, when merely selected groups can be employed.

In Ingham, eighty miles north of Townsville, the percentage obtained on examination was 4.

At Palm Islands, the aboriginal settlement close to Townsville, the whole available population of 489 persons was examined and an incidence of 3.7% was obtained.

Figures are as yet incomplete for Cairns, Port Douglas and Cape York Peninsula. It is probable, however, that areas of endemicity will be discovered in these localities in confirmation of previous reports. Slides with filariæ have already been obtained from Normanton in the Gulf of Carpentaria. So far as is known, cases of filariasis occurring on Thursday Island are imported, no cases being known to arise locally.

The inland towns of Queensland at any rate beyond the coastal range have not been found to be infected. Charters Towers on the crest of the range referred to and eighty miles inland from Townsville has produced, however, a considerable number of cases. No cases occur further inland in our series, except such as have been imported. There are references to cases occurring at Winton, which is far removed from the coast, but no evidence is forthcoming as to whether they are indigenous to that locality.

For the Northern Territory, cases are known to exist, although they are not numerous. Goldsmith, of Port Darwin, reported in 1899: "Of filaria I have only seen two cases while here, one an aboriginal woman with elephantiasis of the vulva which I amputated, and from which she made a good recovery, and the other was a case of chyluria occurring in a Japanese man." In the small series of cases examined in the Northern Territory filariasis has not been detected during our investigation.

Practically speaking, therefore, the distribution of filariasis in Australia may be described as being confined to a narrow coastal strip from the northern rivers of New South Wales to Cape York and including the south eastern corner of the Gulf of Carpentaria. The Northern Territory is possibly infested to a slight extent and a similar condition may exist in the north west of Western Australia. There are at present, however, no evidences to confirm this latter hypothesis. The type of parasite is definitely *Filaria bancrofti* with a well marked nocturnal periodicity related to the night-biting habit of its host, *Culex quinque fasciatus*, more commonly called *Culex fatigans*.

SOME DEFECTS IN COUNTRY HEALTH ADMINISTRATION, AND A PRACTICAL REMEDY.

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The Health of Australia as Compared with other Countries.

Australia is commonly looked upon as one of the most healthy parts of the globe. On the broad basis of published statistics one cannot do otherwise than accept that view.

For the decade terminating just before the influenza epidemic, Australia's general death rate averaged between 10 and 11 per thousand population. New Zealand's averaged between 9 and 10. There was next a group consisting of England and Wales, United States and Sweden, which were closely alike, averaging about 14 or slightly over. Germany and Ireland came next averaging about 16 or 17. The death rates of all the other principal countries of the world averaged about 18, scattered generally between 18 and 25.

We might for convenience classify all deaths along the following general lines:

(i.) Deaths which are inevitable, that is which result from fundamental causes which not even the most optimistic believe can be brought under control.

(ii.) Deaths from diseases which there is more or less reason to hope may one day be preventible, but which today are controllable only in a slight degree if at all.

(iii.) Deaths from diseases regarding which enough is known as to the origin and method of transmission of infection to justify the term "preventible," providing well recognized principles of prevention are applied.

This last group may again be sub-divided and the significant part of it with which I propose now to deal, is the group of intestinal diseases, or to use a less technical but a more vivid term, the "filth diseases."

Among this group typhoid fever or enteric fever has long been recognized and is still recognized as an excellent indicator of the sufficiency of sanitary measures in a community.

Let us then examine the statistics of typhoid fever for Australia and for other countries and see what Australia's relative position is. I am going to show that its position is bad and I am going also to show how bad it is in spots.

From various sources I have obtained the death rates from typhoid fever in sixteen countries other than Australia. I have set forth the mean death rate for the five year period 1916 to 1920 where obtainable; otherwise I have specified the recent period covered by the figures. I have also set down where obtainable the mean death rate for a period of several years about a quarter century earlier. The detailed figures are given on Table I. For the sake of convenience in comparison they have been arranged in order of magnitude of the mean death rate for the recent period. This shows Spain at the bottom of the list with the high typhoid death rate of 0.290 per thousand population and Switzerland with the most favourable typhoid death rate of 0.021 per thousand population. Among the twenty-two countries including the six Australian States separately, Victoria holds the sixth best position, South Australia the eighth, Tasmania the tenth, New South Wales the thirteenth, Western Australia the fifteenth and Queensland the eighteenth. It seems quite clear from the history of sanitary improvement and of diminishing typhoid death rates in various countries that those countries not holding a favourable position in this list could improve their position by betterment in sanitation and in public health administration. The six Australian States are scattered quite uniformally through the list of twenty-two countries. There is certainly no justification for a contented feeling over this position. The only position which would justify a feeling of entire satisfaction would be to have the several States of Australia grouped at or near the favourable end of this list.

TABLE I.

Death Rates Per 1,000 Population From Typhoid Fever in Sixteen Countries and in the Six Australian States.

Country	Death Rate from Typhoid Fever			
	Mean for period 1891-1894 (except as noted)		Mean for 5 years, 1916 to 1920, unless otherwise specified	
1. Switzerland	0.110	1891-1894	0.021	
2. England & Wales	0.173	1891-1894	0.023	
3. Scotland	0.188	1891-1894	0.023	
4. New Zealand			0.032	
5. Sweden			0.035	1916 only
6. Victoria	0.278	1891-1894	0.036	
7. Netherlands	0.125	1891-1894	0.050	
8. South Australia	0.222	1891-1894	0.056	
9. Straits Settlements			0.059	1922 only
10. Tasmania	0.318	1891-1894	0.060	
11. Bulgaria			0.063	1922 only
12. France			0.070	1916 only
13. New South Wales	0.2.5	1891-1894	0.072	
14. Germany			0.073	1914-1920
15. Western Australia	0.710	1891-1894	0.086	
16. Belgium			0.100	1919 only
17. United States			0.113	
18. Queensland	0.272	1891-1894	0.116	
19. Portugal	0.208	1902-1910	0.187	1913-1918
20. Italy	0.514	1891-1894	0.248	1911-1917
21. Algeria			0.271	1912-1921
22. Spain			0.290	

A Closer View of Australia's Health.

I have set forth the relative position of the Australian States and of other countries regarding filth diseases. Let us now examine the question of variations in the prevalence of these diseases within the country.

From various sources, official and unofficial reports and correspondence I have brought together numerous figures showing the prevalence of typhoid fever in country towns and rural areas. Some of these are morbidity and some mortality figures. The rates derived from these figures I have compared with the average morbidity or mortality rates for the State for the same period in order to show how many times worse some regions are in this respect than the State as a whole. Many of these are shown in Table II. This is by no means a complete list of the places which have excess typhoid rates, but merely covers those for which I could readily obtain figures which seemed reasonably reliable. Neither are these what are commonly classed as epidemics. A number of those could be cited which would show rates far in excess of any given in this table. In general the figures in the table represent what have come to be recognized as more or less normal endemic conditions.

The vital statistics for New South Wales lend themselves to an analysis of this sort better than those of the other States. For the two metropolitan areas, Sydney and Newcastle, the typhoid morbidity rate is only 82% of the average for the State and the typhoid mortality rate is only 96%. Of the other municipalities of the State numbering 133, about one-third whose records show the greatest prevalence of typhoid fever, have been grouped according to their population and their morbidity and mortality rates determined and compared with the averages for the State. The aggregate population of these forty-two country towns approaches one-half the total population of all the country municipalities. This grouping of numerous towns by populations gives population units large enough to eliminate errors which sometimes occur in computing rates on small populations. The table shows that morbidity and mortality rates for these groups of towns run several times as high as the averages for the State.

This condition of high normal endemic typhoid in many places is deplorable. I am reminded of Mark Twain's remark to the effect that "Everybody knows the weather isn't what it ought to be, but nobody does anything about it." But there is a significant difference between Mark Twain's weather and Australia's high endemic typhoid, for while efforts to improve the weather baffle us no matter how hard we try, we can improve typhoid fever conditions. We know how to do it. Of that there is plenty of

TABLE II.

TYPHOID FEVER IN NEW SOUTH WALES.
COMPARISON OF RATES IN FORTY-TWO COUNTRY TOWNS, WITH THE AVERAGE RATES FOR THE STATE.

Number of Towns	Population	Aggregate Population	Factor by which the Typhoid Rate Exceeds Average for the State		Period to which these Figures Apply	
			Morbidity	Mortality	Morbidity	Mortality
3	700-1,000	2,605	4.9	3.4		
5	1,000-2,000	6,831	5.9	3.2		
7	2,000-3,000	16.931	2.4	4.9		
9	3,000-4,000	30,945	4.0	5.5		
5	4,000-5,000	22,471	4.3	3.9	1918–1921	1918–1921
2	5,000-6,000	10,738	1.8	2.4		
5	6,000-8,000	33,471	3.1	2.7		
2	8,000-10,000	17,895	2.8	3.9		
3	10,000-15,000	39,508	1.3	2.4		
0	15,000-20,000	—	—	—		
1	20,000-30,000	26,337	5.3	3.5		

Among these are individual towns whose typhoid rates exceed the average for the State by still greater amounts.

TABLE III.

Town	Population	Morbidity	Mortality	Period
Parkes	3,947	12.9	15.5	
Morpeth	1,060	10.3	0	
Tamworth	7,265	8.0	3.0	
Forbes	4,379	7.8	8.0	
Narrabri	2,354	7.6	9.3	1918–1921
Moree	3,020	6.1	2.9	

evidence. We have actually been doing it and attaining spectacular results in places, but we do not do it in many country towns and rural areas.

Some of the Reasons Why Defective Sanitation Exists.

There is a variety of reasons why insanitary conditions exist of a sort which favour the spread of intestinal diseases. The reason which may probably be accepted as underlying all others, is the apathy of the individual.

Further without intending to cast any reflections upon the capable and energetic doctors who frequently occupy the position of medical officer of health, it is quite within the bounds of correctness to say that they have not all the qualifications which a public health administrator or adviser should have. This is well recognized by many medical officers of health themselves. On my visits about different parts of Australia numerous medical officers of health I have met have taken the occasion to deplore the fact that certain phases of the work which came under their observation from time to time lay quite outside their ken.

The medical officer of health in country towns and rural areas is commonly a part time official. He is poorly paid for his services in this capacity. He is given no special facilities to aid him in this work. His daily round of work as a medical practitioner dominates his view and leaves him but limited time to devote to official duties. What is needed is a medical officer of health thoroughly trained for the special features of public health work and devoting his full time to it.

In many places there is no full time health inspector with proper qualifications. The town clerk in a small community is frequently designated as health inspector in addition to his other duties. A suitable control over community sanitation cannot be exercised in this way.

The local board of health frequently is not fired with the spirit of progress. It has the primary responsibility, but in the complex problem of public health there are many phases in which the local board has had no training or experience and if left to itself it has simply to "muddle through."

The State office of health administration is too remote from country towns and rural areas. It is there that close and constant contact is required with the details of health work if good progress is to be made. It would seem as though the local board should have a competent authority to whom to turn for advice and for a certain measure of active help, and clearly under present arrangements this should be the health office of the State. Yet in some of the States the local boards get very little practical help from that office. As a rule it is not staffed for any considerable exercise of local powers and the practical result is that the local boards handle their problems of public health to a large extent according to their own lights with very little help from outside. The State is oftentimes restricted in the exercise of health functions by the lack of funds, also in many cases by the inadequate exercise of police power.

The Need for Improvement in Rural Health Administration.

All of the foregoing point to the need of radical improvement in methods of rural health administration. Reverting to the opening statement regarding the health of Australia, it appears that while the total death rate for the Commonwealth is low, the death rate from intestinal diseases is not, particularly when examined in detail. Intestinal diseases form an important part of the third group, that is preventible diseases, in the broad classification I gave in the early part of this discussion. Therefore the first group, inevitable causes of death, and the second group, diseases but slightly controllable if at all, must be relatively low. Many natural conditions in fact are favourable for this; the salubrious climate, the great open spaces and freedom from congestion, the out-of-door life and the sociological and financial position of the country. What could be clearer than that Australia might have a position in the health of the world conspicuous and favourable from every point of view, if we would only prevent the preventible diseases?

A Practical Method of Accomplishing this Improvement.

Better results in the protection of the public health could be attained by making use of the principle of co-operation among neighbouring communities, thus serving a larger population and greater rateable resources with a single organization. And, with the position thus materially strengthened, could be established a health office for the joint service of these communities, staffed with full time officials who have had special training for their

health work and provided with essential special facilities. At first blush this may sound quite ambitious for country districts. The administration of the public health like administration of any other affair has its business side which must not be ignored. The size and the cost of the organization and the extent and cost of the work it does must not be too large in proportion to the financial ability of the benefiting population and must be broadly consistent with the health benefits which may be expected as a result of its activities. Nevertheless, a scheme of health administration can be developed along these lines at a cost by no means excessive, having the elements necessary to overcome some of the serious defects in present methods of country health administration.

Each State could be divided into health districts under the control of a full-time medical officer qualified for administrative work in public health. He should have the assistance of a full-time sanitary inspector, preferably a graduate in civil engineering with the necessary additional training in sanitary engineering. Laboratory facilities should be provided and adequate motor transportation to enable any part of the health district to be reached promptly at any time.

THE SCIENCES UNDERLYING PUBLIC HEALTH.

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The methods by which the community may prevent disease and improve health, are so many and so varied that a wide range of knowledge is essential to the profession of public health. Of the many sciences underlying public health some are fundamental—as mathematics, physics, chemistry and biology—and furnish the basis for those sciences which belong more specially to public health.

The great variety of these essential sciences may be illustrated by a few examples. To protect health the human spreader of disease must be controlled with a minimum of interference with his freedom. This requires knowledge of epidemiology, clinical diagnosis, bacteriology, protozoology, serology, public health law and the elements of sociology. Likewise, the promotion of health is facilitated by persuasive public education in the fundamentals of healthful living. In this an understanding of psychology, education, and publicity is needed, together with a groundwork of dietetics, dental hygiene, physical culture, food chemistry, and personal hygiene. To adjust man's environment for his physical good, we cannot get along without men trained in sanitary engineering, industrial hygiene, entomology, veterinary science and housing.

The Need For Training In Public Health Science.

Considerable specialization is required of workers in so wide a field as that of public health. But before considering examples of public health sciences as specialties, it will not be out of place to emphasize the need on the part of the health officer and administrator for intensive training in general public health sciences and to speak of the essentially scientific nature of modern public health practice.

Of all the scientific men needed for the advance of public health none is more important than the general public health man, the full-time health officer with special training. It is the absence of such men that is largely responsible for the present rudimentary state of public health work in most towns and rural districts. The part-time medical officer of health now found in rural communities has his soul in the practice of medicine with its exacting responsibilities and only exceptionally understands public health or has its viewpoint. Society needs to adjust its health organization and artificial health-district boundaries so that people on the land may employ full-time health officers with trained assistants and get continuous health supervision as scientific as that in the cities. The Commonwealth and States could supply the more highly specialized types of service, such as extensive sanitary engineering and epidemiologic investigations and laboratory work at convenient centres. Only with effective permanent local health services under the charge of local health officers who appreciate the value of the various sciences to public health, can the efforts of the Commonwealth and States reach full accomplishment.

But if science is so necessary to the local health officer, it is equally so to the man at the head of each governmental health organization. He should be more than a scientist and administrator. He should be nothing less than a sanitary statesman. It is he who ties the health department into the governmental system through which the people must act. It is he who plans the health campaign as a whole and determines the degree to which it is to be based on scientific principles. His is also the delicate task of protecting the men under him from political pressure and local interference, so that public health practice may truly be based on the sciences. To appreciate science, plan the work of scientists and select personnel he should himself have a wide scientific training and experience. We are justified in speaking of his specialty, public health administration, as a science. It includes knowledge of government, health legislation, business and polities in the best sense, as well as a discerning insight into public health problems.

The Practice of Public Health Essentially Scientific.

But can the practice of public health be essentially scientific? That it can under reasonably favourable conditions, is one of the attractions which has drawn into it many devoted men who could have acquired more of the world's goods in the practice of medicine.

To illustrate the opportunities for applying science in the practice of public health, it may be compared with the practice of medicine. In public health we are dealing with groups, often very large ones, and errors in observations and statistics tend to balance each other in the larger figures. In medical practice, on the other hand, the small numbers dealt with often make it difficult to draw safe conclusions. Moreover, the essentially impersonal relation of the full-time public health worker to the benefiting public favours scientific thinking. The success of public health work is measured statistically and evaluated by trained associates more competent to judge scientific attainments than are the individual patients of the physician.

A thorough scientific groundwork is not only practic-

able, but is essential if success is to be gained. It is the common experience that public health undertakings planned on a sound scientific basis often produce results beyond expectations. When the results looked for do not eventuate, further study usually shows that some essential factor was overlooked in the preliminary investigation. The scientific foundation was inadequate. Perhaps, through mistaken economy, specialists were not employed for highly technical phases of the work.

The Science of Epidemiology.

Ten years ago one would have been inclined to describe the activities of the public health laboratory as the best example of the application of pure science to disease prevention. The laboratory relies chiefly on such exact sciences as bacteriology, protozoology, serology, pathology and chemistry. Within its walls scientific work and thought may go forward unhampered. But to-day the science of epidemiology seems the best example. The term epidemiology is here used in its modern and broadest sense. It is the science which uncovers the laws governing the rise and fall of the prevalence of diseases and points out how this knowledge may be applied for prevention.

The epidemiologist reaches his results through field studies supported by laboratory investigation and analysed with the help of modern statistical science. By considering facts from many sources he throws light on problems which baffle the worker in the laboratory, the field or the library alone.

As a rule the epidemiologist is a medical man, as training in diagnosis, pathology and medical bacteriology is essential to the identification of the diseases investigated. His medical course needs to be supplemented by intensive study in a modern school of public health and a period of preliminary experience in the laboratory and the field.

A man fitted by natural ability, temperament and special training for epidemiological work should be kept in it with such advances in rank as his work merits. He should not be wasted on extraneous duties or promoted out of his scientific work into an executive position.

Just as the trained local health officer is expert in the more usual problems and crises of public health, so the epidemiologist soon becomes familiar with the difficult and unusual. He investigates manifestations that perplex the local health officer. But the epidemiologist is not only a scientific "trouble-man," disease-detective and field investigator. More and more is he devising methods for the constant, automatic revelation of disease trends and danger signals. Under his direction the reported weekly numbers of cases of diseases are plotted in curves for each district and each important disease. Any distinct deviation from a curve showing the incidence in recent years is investigated. Local health officers are warned when trouble is brewing in their districts or approaching from elsewhere. The central health department by the same information is enabled to send assistance into threatened districts. By thus anticipating serious crises and the accompanying panics, the health department minimizes the danger of being rushed into unscientific procedure by public pressure, in the absence of time for thorough investigation and cool judgement.

The Need for the Non-medical Scientist.

There are public health problems, however, which are outside the range of the epidemiologist with medical training, or the other medical health officers. The more technical problems of sanitary engineering are a good example. For a medical man with post-graduate public health training to attempt to solve an intricate problem of sewage disposal, on the ground that it has an important bearing on public health, is almost as inexcusable as for a sanitary engineer to make diagnostic examinations of typhoid fever patients because their illness is related to his problem of defective sewerage. There is no place for the amateur in either field, for "a little knowledge is a dangerous thing." A modern education in sanitary engineering cannot be gained except by a thorough engineering course supplemented by the study of biology and public health. To meet its full responsibility for safeguarding the health of the people the health department must have its staff of trained sanitary engineers.

As one looks about one finds health departments taking increasing responsibilities for institutions for the cure or palliation of disease while assuming relatively little of their normal responsibility for prevention through the application of the non-medical sciences. Important among the danger points needing control by health departments are the sources of water supply, the outfalls of sewers, the dairies and pasteurization plants and the breeding places of disease-carrying mosquitoes. If some important public health specialties have drifted away from the health department or were never in it, it is time to bring them in. If the public health field is to attract medical men of the right stamp, it must be kept on a high scientific plane by attracting also the other scientists necessary for a balanced staff.

It is probable that medical men will continue to hold the highest executive positions in public health organizations as long as the quality of their public health training developes fast enough to satisfy the ever-rising scientific standards. There is an increasing tendency to make the Diploma of Public Health a prerequisite for appointment to the more important positions and in future more and more medical graduates will take courses in the schools of public health which are being founded. In such schools are found teachers who devote themselves to the application to public health of the various sciences in which they specialize. One of the most serious difficulties which holds back the advance of public health, is the shortage of men trained for the work both scientifically and by experience.

Application of the Sciences to Public Health.

Unfortunately the knowledge already available is not being fully applied to public health problems. There are not enough trained investigators and public health laboratories. We are too often satisfied with the checking of disease outbreaks, when they might have been anticipated and truly prevented.

To get a more complete application of up-to-date knowledge to everyday health problems, we need not only enough trained men but also adequate organization. Developement is needed both in the central health departments and locally, but the local and central activities

should be organized into one system and should supplement each other. The local communities cannot give permanent employment to a wide range of specialists and must depend on the central departments for consultation and direction. The central departments are dependent on the local services for continuous and detailed local health administration. Central departments may combine to make a national drive against some outstanding disease, as in the Hookworm Campaign, but sooner or later the work reaches a stage when it should be carried on by local health services with assistance and direction from the central departments.

Public health is a glorious profession in its motives and opportunities. It needs better grounding on science and a larger proportion of trained scientific workers to obtain through demonstration of results the full recognition of its importance and value.

Section VI.—Ophthalmology.

PREVENTIVE OPHTHALMOLOGY.

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In taking the chair to which the Executive Committee invited me, I need not say that I am deeply sensible of the honour and responsibility attached to the position which under another organization in past years has been so worthily filled by more experienced ophthalmologists than myself. Indeed, the consciousness of my inability to take my place as their lineal descendant would not have permitted me to accept the Presidency had it not been that I felt the Executive Committee on the occasion of the first Congress held under the auspices of this branch of the British Medical Association wished especially to manifest its desire to cultivate reciprocal feelings of interest and loyalty between the members in the larger capitals and those in the outlying centres. So, in spite of my misgivings you find me here, glad at being able to express my thanks for the consideration and compliment paid to Western Australia.

While I cannot in my occupancy of the chair expect to approach the urbanity of Dr. Kenny who presided at these sectional meetings of the last Congress in Brisbane, I hope any shortcomings on my part will serve only to elicit from you a sympathetic leniency and a generous support.

Knowing myself the difficulties in attending Congress it augurs well for the future to see so many here and, for the moment, I may constitute myself the mouthpiece of each in welcoming the rest to these ensuing discussions where friendly intercourse should lead to mutual appreciation and a disappearance of any angularities that may have arisen from lack of contact in our own individual spheres of action.

Let us, as Pasteur said, "worship the spirit of criticism. If reduced to itself it is not an awakener of ideas or stimulant to great things, but without it everything is fallible." When the centenary of Pasteur's birth has been so recently celebrated by expressions of homage of civilization to his memory, it is fitting that the Federal Committee should desire that throughout this Congress the preventive aspect of medicine should be kept in mind, to stimulate the application of modern research and extended experience, not only to the improvement of treatment, but also to the forearming of a susceptible world against metabolic perversion and the attacks of the "infinitesimally small." So far from "specificity immobilizing medicine" according to Pidoux, one of Pasteur's opponents, it secured even in his lifetime triumphs in therapy and prophylaxis.

The early history of medicine and ophthalmology has little of prophylaxis in it, and what aseptic principles there were in the Arabian schools lost their vitality in the debilitating environment of the Middle Ages. It required the epochal work of Pasteur and Lister which substituted scientific data for scholastic hypotheses, to make possible the preventive measures of to-day and their further evolution in the future.

It is difficult for those of us who have only practised surgery long after their ideas have passed universally into practice to appreciate the anxieties of the pre-antiseptic day. Few figures are available to me to show the extent of their benefactions to ophthalmic surgery, but Professor Zehender quoting in 1887 a paper by Horner, of Zurich, at the International Congress in London (1881) showed how at that school alone a post-operative loss of 10.1% of cataracts removed by the flap operation and of 4.8% by the linear method was reduced to one of 1.5% by the adoption of antiseptic measures, a figure that agrees closely with 1.0% quoted by Harrison Butler more recently for total losses which I believe would be typical of many other clinics. That was twelve years before Gasparinni demonstrated the rôle of the pneumococcus in intra-ocular infections and pointed out thereby one direction in which caution should be exercised.

The modern methods of investigation of the conjunctival flora have differentiated further pathogenic infections, although opinion may vary as to their relative importance.

Elschnig and Lindner both highly efficient investigators agree as to the unnecessary refinement of differentiating between the pneumococcus and the variable streptococcal group, whether hæmolytic or not, classing the two together practically as pneumo-streptococci. They differ, however, as to staphylococcus. Lindner using the serum bouillon in the Elschnig-Ulbrich method (serum one part to bouillon three parts) found after twenty-four hours' incubation a culture growth of staphylococcus in 37% of cases and contrasting the prevalence of the organisms about the lid margins and the great probability of infection therefrom of the media, concluded that as sources of danger they need not prohibit operations. Elschnig on the other hand and Harrison Butler also have published cases where by culture from the aqueous or excised portions of iris the staphylococcus was apparently the only causative agent present. They therefore concluded that preventive measures must also be taken against the staphylococcus no matter what the colour in culture be.

Lindner's opinion was further strengthened by his studies of the distribution of organisms in the conjunctival sac which furnished two tests for pathogenicity: (i.) A correspondence between the topography and the clinical

signs and (ii.) the occurrence of the organism in question in living epithelial cells.

By these the staphylococcus appeared to be saprophytic. It would seem, therefore, that just as a non-hæmolytic streptococcus may assume hæmolytic properties, the saprophytic staphylococcus of the sac may become pathogenic in the interior of the eye.

This method of Lindner of examining epithelial scrapings from each lid and from diametrically opposed areas on the bulbus has led to the valuable observations that smears of secretion and cultures made from the same source may give a negative but an epithelial scraping preparation from the same case a positive finding, a most probable explanation of post-operative infection where the usual bacteriological examination gave no warning.

The obvious moral is in suspicious cases not to be content with an initial failure to grow bacteria from a secretion smear, but to corroborate it by an epithelial preparation from the lower and upper lids. These investigations have further demonstrated the frequent invasion of the bulbar before the palpebral conjunctiva by pathogenic organisms which apparently continue the pathological process, as Lindner suggests, by passing from one minute area of acquired immunity to another as yet unprotected.

The value of his method in early diagnosis is exemplified in the case of a student who presented himself for examination, as he feared he had infected his eye with gonococci about eighteen hours previously. There was only a slight hyperæmia and no purulent discharge, but the epithelial specimen from the inferior portion of the conjunctiva displayed gonococci. Only eight hours later did flecks of muco-pus appear. The case turned out to be one of unusual severity leading to perforation and subsequent reduction of visual acuteness, in spite of iridectomy, to one-tenth of normal.

In my own practice all patients before major operation are examined by smear and blood agar cultures and when organisms are obtained the treatment is postponed. So far I have lost no cataract patient through hypopyon, keratitis or panophthalmitis, although one patient lately caused anxiety by the appearance on the fifth day of a small hypopyon of undetermined ætiology. It ought to be possible to eliminate misfortunes due to extraneous infection.

Lindner publishes an average of losses of 0.3% to 0.6% for a clinic where operators of dexterity and care have the handling of the cases and Bernheimer's percentage of 0.25% closely agrees with Lindner's in showing what can be achieved by modern prophylaxis thoroughly and efficiently carried out. Yet even with the greatest care post-operative iritis or irido-cylitis of varying degree may be got and the source is difficult to determine and therefore to anticipate, because of the possibility of endogenous foci. Pyorrhœa is not always to blame for I, as many others must have done also, have operated in its presence, provided the general condition of the patient was good, without inflammatory sequelæ. It may be as Harrison Butler says, the apical abscess cases that are dangerous, but I am not aware of any statistics which would enable the surgeon to assess the degree of danger in operating on patients with naso-pharyngeal foci or gastro-intestinal toxæmia in general surgery. However, I feel that in these cases particular care should be taken not to impair that vitality of tissue that concerned Lister so greatly in his early investigations.

Fresh problems present themselves with emergency operations where a clean conjunctival sac cannot be always confidently expected and with perforating injuries which in the early stages may show no trace of infection or it may be only such hyperæmic conditions that might be construed as physiological reactions to the traumatism.

Can one forearm the body against an organismal invasion of the eyes to prevent its establishment or weaken the attack?

Darier has long espoused for actual and possible infection the use of antidiptheritic and plurivalent sera. "In all infections," he wrote, "the exact nature of which has not been determined, and while waiting for bacteriological diagnosis one may be able by the administration of a draught containing twenty cubic centimetres of antidiptheritic or plurivalent serum accompanied by an injection of milk to cause rapid abortion of infective processes." Jacovides has used Rohmer's method of subconjunctival injections of auto-serum obtained after blistering and has found it a powerful ally in the treatment of *ulcus serpens*. Müller and Lindner advise the prophylactic use of intramuscular injections of milk before operations in doubtful cases. I have like others seen great benefit result in the treatment of infected ulcers by antidiphtheritic and horse sera, but latterly I have been using milk injections according to the Vienna procedure, boiling the milk for four minutes only. The doses have ranged from four cubic centimetres for a child to ten cubic centimetres for an adult and no more than four injections have been given at intervals of one or two days. I have not yet seen any of the alarming symptoms such as anaphylactic shock that led Lubliner, Jickel, Holler and Steiger to recommend great caution, although sometimes the reaction as shown by the rise in temperature to 39° C. (102.2° F.), may be considerable.

The mode of action of these injections is indetermined. Fradkine thinks the results are due to an abundance of alexins, the increase of which was proved by Lüdki acting on "microbes already sensitized by their specific fixation agent"; Lindner and Pillat, in some measure, to the rise in temperature altering the metabolism and the protective agencies of the body, possibly through the absorption of the products of disintegration of the albumin; von Thanner, Müller and Guist to increased leucocytic activity apart from the higher temperature.

Müller and Van de Felden also regard the local reaction as important. In my own experience I do not find the temperature chart is a certain indication of the good benefits to be derived, although they are closely related, but that some general alteration is produced as apart from local changes would seem to be evidenced by the discovery of Uddgren that previous failure to respond to the Wassermann test may give place to a reaction. The local reaction may be intense. I have, for instance, seen a hypæma occurring in iritis.

It is difficult without suspending all other treatment to gauge how much improvement is to be attributed to the milk alone, yet I am confident it has aided the arrest of infected corneal ulcers which were spreading in spite of

the usual treatment by cauterization easing the pain by reducing the iritis and hypopyon. The most recent patient an infected ulcer of the central area of the cornea which was producing a steadily increasing hypopyon within twelve hours after receiving the first injection, showed both in a diminution of the hypopyon and a cleaner base of the ulcer the first improvement for three days. The other treatment had not been changed meanwhile.

Cases of acute recurrent eczematous pannus which had proved very resistant to other treatment, improved at least for a time, but as Berneaud has reported no immunity is secured and relapses occur. Probably it is, as he suggests, through the absorption of imflammatory products securing a freer access of the immunizing bodies to the foci that good results accrue.

Although this question of mechanism is unsettled, the results are sufficiently encouraging to continue and extend the use of paraspecific treatment.

One cannot forbear to mention the results of the milk therapy in the treatment of gono-blenorrhœa in Vienna in the hands of Lauber, Lindner, Pillat and Bachstez and of Berneaud in Kiel, in doses of two cubic centimetres repeated four times as the routine course. In the absence of all other treatment than weak, cleansing solutions of potassium permanganate or sodium chloride Pillat examining epithelial scrapings found a disappearance of the gonococci from the ocular conjunctiva after two injections and from the palpebral and fornical only somewhat later after three or four injections.

Lindner finds the same disappearance in a few days, whereas with the older silver nitrate treatment the gonococci may be demonstrable for two weeks. Clinically the reduction of the œdema and the improvement of any corneal lesions are presented and Lindner bases his advocacy not only on the shortened course of the infection, but on the almost entire absence of corneal involvement since the treatment was established.

In one case at the King Edward Memorial Hospital two weeks ago the baby in question showed the left eye closed by the œdema of the lids, the separation of which allowed a profuse discharge to escape. As usual the conjunctival swelling was sufficient to conceal the bulb. After an injection of 1.5 cubic centimetre within twenty-four hours the swelling and the discharge were greatly reduced and at the end of one week scarcely any discharge could be found. The bacterial content as estimated approximately from smears every second day showed a rapid diminution of the gonococci. The child had been having 5.0% "Argyrol," but the quick subsidence of the symptoms was out of all proportion to the effects of the drops.

When in a recent publication one sees only the old methods advised, one is inclined in view of the results to urge this treatment which in Zimmermann's words would render "an attempt with the injections imperative in every case."

In addition to these helpful bacteriological and biochemical measures I believe that an extended use of conjunctival flaps to cover over open wounds would appreciably diminish the risk of post-traumatic inflammations. I use them systematically even to the complete covering-in of the cornea where the wounds are extensive and in my opinion there is no equally effective procedure of guarding against further accidental occurrences during convalescence in injured children who cannot always be trusted to behave as requested. It is worthy of consideration whether such a covering ought not to be included as a part of routine emergency practice.

On the other hand I have found the flap as I saw used with success by Stanculeanu at Bucarest in cataract extraction occasionally a source of worry on account of its tendency to retract. In a case of high myopia with fluid vitreous where I wished to use such a flap as a splint against the possible restlessness of the patient, it was almost impossible by the most extensive undercutting to get sufficient for the purpose and the thin conjunctiva after all did not survive the unusual occurrence of severe vomiting in the first twenty-four hours.

In connexion with this question it is of great interest that the slit lamp has shown that there can exist transient forms of sympathetic ophthalmitis which resolve entirely under treatment, the minute deposits on the cornea and on the supporting structure of the vitreous entirely disappearing. These vitreous deposits may occur in clinically quiet eyes and are to be looked for especially in the lower parts. On the other hand this method of investigation has still left unanswered the question as to whether the so-called sympathetic irritation is a form of ophthalmitis or not.

In leaving behind the diseases and complications due in infections I will only note that if one were to group together the three essentially preventible diseases—trachoma, syphilis and *ophthalmia neonatorum,* I calculate an efficient prophylaxis would reduce the out-patient eye clinic at the Sick Children's Hospital, Perth, by 12% and the in-patient eye clinic by 30%. But it would be superfluous for me to refer in this city to the important part played by syphilis in the production of eye diseases after the elaborate investigations of Sir James Barrett and Dr. Orr or to speak of the measures taken to check its prevalence, as the pioneering legislation of Western Australia in this respect was fully discussed at the last Congress in Brisbane, yet it would appear that discovery of cases of congenital syphilis should serve to bring the parents within the scope of the clinics more than it does at present.

As we pass away from this series the prophylaxis becomes more difficult to evolve, although in the number of eye diseases certain categories can be differentiated. Thus certain local diseases conditions, for example, heratomalacia and the cataract of cretins, have been definitely proved to depend on more general diseases and here the indications for prevention are obvious, although not always possible. But when consideration is given to those others whose ætiology is unknown, and when it is uncertain whether local or general pathological conditions are the more important, the problem of discovering an effective method of prophylaxis becomes intensified. Thus imbalance of the internal secretions may and does produce ocular changes, but whether the pathogenesis of senile cataract will be finally found to depend largely on the diminution of the testicular or ovarian secretions is still on the lap of the Gods.

Vogt's work on cataract does suggest to me that nothing less than bodily regeneration or gland grafting will prevent or arrest the onset of these cataracts that are destined

to reproduce in the disintegration of the lens the processes of anatomical dissections, but where the cataract is more an atypical and amorphous degeneration, it may be found possible to anticipate the onset or advance of these pathological as distinguished from what we may call physiological cataracts.

Sometimes I think by minute examination of the particular vacuolation, cases have been retarded or arrested, but whether the use of the therapeutic means at present available have been directly responsible, requires for an accurate deduction a large number of cases and observations over a term of years. Up to date my material is not sufficient to enable me to state the effects as percentages of successes or failures, nor have I seen reports in the literature by reputed opthalmologists to justify the rosy optimism of the lay press.

The same length of years and numbers will be required to separate out from the tangle of possible influences the underlying general conditions, if any, that prepare the way for the glaucomatous to travel as they pass from health to their undesirable affliction.

The use of the word inflammatory in general surgery to describe an acute attack postulates as a rule a bacterial or toxic irritant and it may be that here although used pictorially its use will be justified by later researches and point out some way of prevention.

I am satisfied some such cause was at work in a striking case of my own wherein a lady after a series of fugitive episcleritic attacks experienced a sudden rise of tension to T + 2 which was completely relieved by eserine within an hour. Thereafter there were small oscillations of one to two divisions of a Schiötz scale until her pyorrhœa was removed by the extraction of the teeth and since then over four years ago there has been no recurrence of any trouble. What has happened in one case may happen in others. La Grange also accepts an origin such as this as a possible cause of hypersecretion which he regards as a primary cause of glaucoma.

Lindner's recent investigation on the changing of the aqueous humour after the administration of "Uranin" in doses of four grammes dissolved in black coffee and taken after a light early breakfast revealed a similarity between an acute glaucoma and an acute inflammatory case, such as iritis. In normal eyes the greenish tint as observed with the Nitra slit lamp or Micro-arc light, which can detect a dilution of one to three hundred millions, appeared in an average of eight completely normal cases in twenty-five minutes, reached its maximum intensity in one and a half to two hours and disappeared from the anterior chamber in forty-eight hours at longest. In the patient with unilateral iritis who had had a milk injection some days before, it appeared in the inflamed eye in eight minutes and its concentration curve rose sharply and fell sharply. In the sound eye it appeared in seventeen minutes and reached its height more slowly, but the inflamed eye retained a minute trace the longer. In acute primary glaucoma the curve showing the time of appearance, rapidity of concentration and disappearance was the type of the inflamed eye—the anterior chamber being free in one to one and a half days as against the average normal of two days.

It is of interest to note in passing as affecting the retention theory that the slit lamp has shown by the anterior chamber remaining optically empty that the secondary aqueous in man formed after tapping the anterior chamber is not albuminous.

Particularly striking was a case in which the pressure was unequal in two eyes, the "Uranin" disappearing first on the side of the higher pressure during a second attack of increased tension on the second morning. Whether the rapid appearance be due to hypersecretion or to an increased permeability of the vessels, the rapid disappearance is difficult to reconcile, as Lindner says, with a theory of retention, although a back wash into the vitreous body is not to be lost sight of, as in it traces can be found after their disappearance from the anterior chamber. Considering only cases of primary glaucoma I feel myself being drawn by these modern researches to the increased inflow hypothesis, which seems to me to add to the importance of the disease from the point of view of the general condition of the patient and to increase rather than to lessen the chance of prevention.

This tendency to focus on an increased inflow whether due to a hypersecretion, as Bjerrum thinks, or to vascular alteration produced through the nervous system, as Hamburger, La Grange and Magitot incline to believe, has had the effect of stimulating research into the systemic conditions in an attempt to sift out the essential from the accidental and thus to arrive at the scientific basis of treatment therapeutic or preventive.

Sulzer and Ayrignac found a hepatic insufficiency and frequent intestinal trouble together with an alteration in renal impermeability constantly present in the class of primary glaucoma, but absent in optic atrophy and secondary glaucoma.

Dieting was found to give operative measures better results and also to benefit those patients who, though showing no eye symptoms, were investigated as presenting the above mentioned symptoms and were in turn found to possess variable, though possibly physiological slight ocular tensions. The last patient with acute bilateral glaucoma that came before me was a thin sallow faced, toxic-looking woman with no history of an illness, but of most obstinate constipation associated with a fear of hæmorrhoids. I have notes of another case of a man about seventy years whose glaucoma had apparently remained long quiescent, but who suffered a rapid deterioration of sight from an increase of tension after an attack of jaundice.

Fischer supported by Hayward Thomas and Leonard Hill also ascribes his acidosis to toxins or altered metabolism, local or general.

Yet another aspect has been revealed by Hertel's demonstration of the variation of intraocular tension with the molecular concentration of the blood. The finding of a molecular concentration below the average in young glaucomatous subjects free of organic disease may bear some correlation to the mineral instability of Sulzer and Ayrignac, but the effect on the vessel wall of the varying concentration has to be remembered as Lindner found in his own investigations with "Uranin." He also showed that in some way osmotic interaction and the salt content of the blood was affected by the amount of thyreoid secretion. The fact that by drinking such solutions as twenty

to thirty grammes of salt dissolved in two hundred cubic centimetres of water he was able to reduce his own normal tension so low that the act of winking caused distortion of images, shows at least how miotics may be temporarily assisted and operative risks diminished. Yet I must confess treatment based on these findings is as yet uncertain, although they have been in one or two cases an efficient substitute for the posterior sclerotomy when indicated as a preparatory step to further operations.

The recrudescence in favour of the theory of increased inflow gives a possible scientific basis to the cyclo-dialysis which is at present so greatly in favour in Vienna, and which Elschnig considers will with iridectomy become a more widely used operation than trephining which in Vienna has fallen into some disuse on account of the tragedies of post-operative infection, to use Harrison Butler's expression, and is leading to trephining being used there mainly as a last resort in intractable cases. Be these general conditions as they may, in the past few years I have had cases where the question of a rise in tension was suggested by the persistent asthenopic symptoms. They were all patients between forty-five to fifty-five; no proper lenses or none at all had been worn for some time. The tonometer showed a slight rise which disappeared permanently after using a correction and a short course of weak eserine and I am inclined to believe it was due to efforts of accommodation causing irritability and consequent hyperæmia about the ciliary area, thus leading to a slightly increased inflow. Maddox has found the same.

It is evident from this résumé that the field of investigation is large and calls for research by ophthalmologists and ophthalmic physicians who Rayner Batten wishes attached to all eye clinics. While so much remains to be done, I ask myself is it economical to demand as in London from intending oculists who propose to proceed ultimately to hospital appointments high surgical degrees pursued at distinguished colleges rather than to require from the aspirants a sound general medical education as is provided by the teaching universities of to-day reinforced by the practical experience of an interval of general practice especially on its medical side, and for the final academic qualifications a diploma or doctorate based on research and further whether in the interests of the advancement of ophthalmology in Australia the time has not arrived to inaugurate an Australasian Ophthalmological Society which could establish a comprehensive central library of current ophthalmic literature which after indexing would be available, if need be, by post to those wishing to read the latest publications on any particular subject.

To show the value of such a library I need only mention the one instance of Lister not having discovered Pasteur's papers that set him working on his future system of antisepsis until eighteen months after their publication, although he was on the outlook for anything that might help him to solve the problems before him.

Investigations in any direction without the knowledge of what has already been done in the matter is a waste of time.

There is still much that might be said did time permit of such happenings as those investigated by the Departmental Committee on the Causes and Prevention of Blindness, but we all know in our own experience how much incapacity could be avoided by industrial regulations based on a survey of the types of accidents occurring in factories, engineering shops *et cetera*, so I will conclude by inviting you to our further work in Pasteur's words "to the peaceful strife of science."

References.

Graefe's Archiv für Ophthalmologie Band C.V. 1921.

Bericht über die XLII. Versammlung des Deutschen Ophthal. Gsellshaft Heidelburg. 1920.

Klin M. F. Augenheil, 1918-1920.

B.J.O.—1918, March.

B.J.O.—1921, January.

A.J.O.—1921, January.